Communications—Electronics—Photography

SIGNAL

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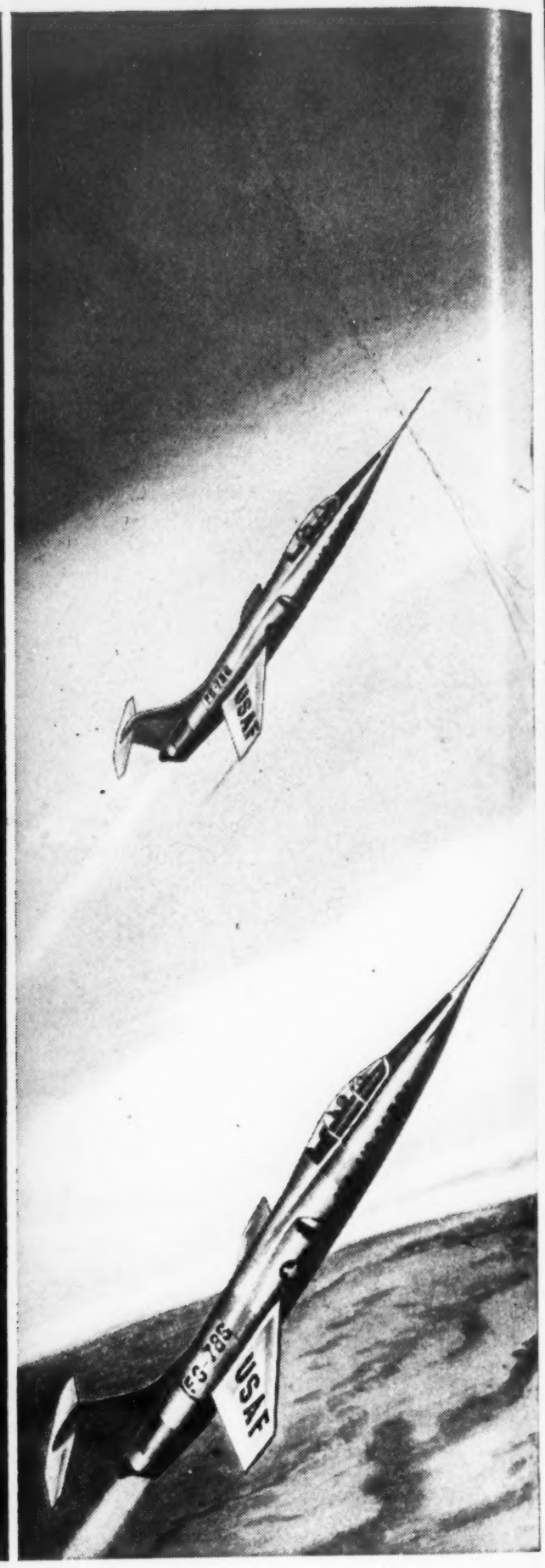
Merrie Christmas

I heard the bells on Christmas Day
Their old, familiar carols play,
And wild and sweet, the words repeat
Of peace on earth, good-will to men!

Longfellow



ON LAND . . . ON SEA . . . IN THE AIR . . .

RCA electronic equipment, systems and components represent high performance and reliability.

Electronics play a primary role in our nation's defense. The success of missions, the detection and pursuit of enemies, the navigation of ships and planes, the maintenance of communications—these and a hundred other functions underscore the vital necessity for both high performance and complete reliability.

To all services RCA has come to mean advanced thinking on present problems. Its broad approach to military electronics and its firm insistence upon reliability of performance, contribute to efficiency of operation and safety of personnel.

DEFENSE ELECTRONIC PRODUCTS
RADIO CORPORATION of AMERICA
CAMDEN, N. J.

SIGNAL

Journal of the Armed Forces Communications and Electronics Association

VOLUME XI DECEMBER 1956 NUMBER 4

1624 Eye Street, NW
Washington 6, D. C.
Phone: EXecutive 3-3033

Editor
W. J. BAIRD

Managing Editor
JUDITH H. SHREVE

NEWS LETTER EDITION

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GOVERNMENT

Tungsten Base Alloys Now Available

A completely new field of research in high-temperature alloys for use in jet aircraft has been opened by cancellation of the quota system on six critical materials by the Department of Defense.

Continued efforts by industry and the military have reduced mobilization requirements for the six critical metals, and additional stockpiling has continued.

The lifting of all restrictions on the use of tungsten in gas turbine engines points the way to rapid strides in the development and use of new alloys more likely to crack the heat barrier than anything currently available.

The lifting of these restrictions gives the aircraft industry opportunity to obtain and use the materials long needed for best results in high-temperature technological requirements.

This new Instruction relieves the Armed Services and their contractors from adherence to quotas, formerly in force, in the use of tungsten and five other materials: cobalt, chromium, columbium, nickel, and molybdenum, for gas turbine engines—a term that includes turbojet and turboprop engines.

Japan to Receive Atomic Reactor

An export license was recently issued to Japan by the Atomic Energy Commission for the export of a research reactor. This is the first time an export license has been granted for a reactor, with the exception of one sent to Geneva for the International Conference on Peaceful Uses of Atomic Energy, which was later sold to the Swiss Government.

The current license covers a reactor to be used by the Japan Atomic Energy Research Institute.

Technical Problems and National Defense

Since the National Inventors Council was created in 1940, it has periodically issued in cooperation with the Armed Services lists of problems to which the military establishment is seeking solutions. In making military needs known to industry, science, and the creative lay public, the Council hopes to enlist and channel inventive thinking along lines which would benefit the defense effort.

The present list supplements the two listings issued in 1954 which were eventually combined in a cumulative reprint. In response to previous issues, the Council received numerous inquiries asking for the name and address of the military agency to which a possible solution should be submitted. The problems were furnished the Council by the Armed Services with the understanding that the Council would assume responsibility for correspondence, interviews, and related work up to the time

SIGNAL is published monthly by the Armed Forces Communications and Electronics Association at 1624 Eye St., N. W., Washington 6, D. C. Entered as Second-class matter at Post Office, Washington, D. C. Additional entry at Baltimore, Maryland.
Subscription rates: 1 year (12 issues), $6.00. To foreign post offices, $6.50.

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Printed in U.S.A. by Monumental Printing Co., at Baltimore, Md. The publisher assumes no responsibility for return of unsolicited manuscripts or art. When sending change of address, please list the old and new addresses, and allow 3 weeks for delivery of first copy.

BPA

when a specific, constructive proposal is in hand.

It is at this point that the descriptive material on the proposed solution is referred to the Armed Services for study, and it is at this time that direct contact with the Services is arranged for those who have presented promising solutions.

The items fall essentially into two categories: those which are not strictly problems but are, rather, indications of general areas in which further technological advances are desirable; and those which are specific, defined problems. It is difficult to supply additional information on the former beyond that available to the inquirer in technical literature. When the inquiry stems from a problem in the second category, every effort is made to obtain the information for the inquirer, provided that he outlines the specific details which he needs.

The Council, designed to serve in an advisory capacity to the Armed Services and other government agencies, is composed of eminent inventors, scientists, and industrialists, with *ex officio* representatives from the Army, Navy, Air Force, National Advisory Committee for Aeronautics, and the Patent Office.

Handbook on Civil Defense for Schools

"Education for National Survival—A Handbook on Civil Defense for Schools," a new Federal Government booklet, urges the Nation's schools to develop strong civil defense programs that will serve to enlighten pupils and adults alike on the need for being prepared to meet and minimize the serious consequences of natural disaster or enemy attack on the United States.

It was prepared by the Office of Education of the U. S. Department of Health, Education and Welfare. The publication outlines information and procedures essential to the development of school protection and civil defense programs.

The foreword points out that a strong civil defense will serve as a deterrent to attack and stresses that Americans must be informed on how they can help themselves and others in the event of an emergency.

Because 25 per cent of our population, every fourth American, is associated with schools—as student, teacher or administrator—the Nation's institutions of learning serve as one of the best means of disseminating civil defense information for personal and family survival.

The handbook is sold by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Quartz Crystals Producers Meet at BDSA

The quartz crystals manufacturing industry must have a "shot in the arm" within the near future if it is to be maintained on a basis that will insure adequate production in the event of an emergency. This was reported by the industry's advisory committee at a meeting with officials of the Business and Defense Services Administration, U. S. Department of Commerce, and other Government agencies.

Preparedness studies covering the industry's capacity to produce the principal types of quartz crystals essential to military electronic equipment during the last six months of 1955 have revealed substantial deficiencies in the industry's ability to meet estimated mobilization requirements, Government spokesmen told the committee.

Many committee members expressed the view that financial support must be forthcoming to enable quartz crystals producers to maintain their operations on a scale considered adequate to meet emergency military requirements. It was pointed out that some crystals have been sold for Government contracts at ruinous prices, with producers bidding for business at less than cost.

Quartz crystals are essential components in equipment used for transmission by radio or television, including broadcasting stations, used to keep the transmitter on its assigned frequency. Government representatives attending the meeting said that a system has been established in the Armed Services whereby responsibility for production of essential items will be centralized and program managers appointed to deal with such problems as those involving the quartz crystals industry.

Electronics in Climatology

Today, even with radar and "all-weather" Air Forces, neglect of weather can bring the risk of instant catastrophe. With the solution of old weather problems, new and more difficult ones appear.

The Air Weather Service, an agency of the U. S. Air Force, does vital work in this area for the Army and Air Force. Specially qualified weathermen analyze the role of weather in equipment design, strategy, and logistics. They calculate important effects to find how military risks from bad weather can be trimmed and good weather use to best advantage.

Of the several hundred projects completed each year, two recent ones each promise to save the Air Force more money each year than the USAF spends on the entire Air Weather Service climatological program.

One of these gave the first large-scale appraisal of weather effects on jet aircraft takeoffs. The other study showed a cheaper way to protect warehoused equipment from rusting.

These, as well as many other studies, had one thing in common—a voracious appetite for data. Compilation of the millions of data cards necessitated a new, high-capacity processing system. This was found in the recently developed large-scale electronic data-processing systems. An IBM 705 has been readied for this work. Using high-speed, high-capacity magnetic tapes and "memories," its production rate almost triples that of the whole machine complex formerly in use.

Contract Awards

Army

The Signal Corp Supply Agency has awarded a million-dollar transistor development contract to Motorola, Inc. The work on the new contract will be performed by the Semi-Conductor Products Division in Phoenix, Arizona, where the company already has a number of transistors in various stages of development and is currently mass-producing an audio power transistor.

Raytheon Manufacturing Company has received contracts totalling $35,000,000 for development and produc

IDEA TO PROTOTYPE ... in just 7 months!

Lewyt cuts delivery time for complex electronic equipment

In developing complex electronic systems for the military, TIME is often the most critical factor. The gap between idea and volume production must be constantly narrowed.

At Lewyt, experienced engineers are at work cutting months from "time in development." Involved equipment, such as Lewyt's Coordinate Data Monitor, urgently needed in the SAGE System, progressed from design stage . . . to breadboard . . . to engineering model . . . to operating prototype, IN RECORD TIME!

Through background and previous experience, Lewyt engineers are particularly qualified to carry out research and development projects in Data Processing and Data Transmission, UHF and VHF Communications, Navigation Guidance, Infra-Red, and related fields. Lewyt Manufacturing Corporation, Long Island City 1, N. Y.

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tion of electronic military equipment. Approximately $6 million dollars of the total will be used for plant preparation.

Air Force

The United States Air Force has awarded the Radio Corporation of America a contract to develop and produce a complete Air-Ground Data Transmission System. The communications system will be designed to meet standards recently established by the U. S. Air Force and the U. S. Navy for a common data link system for application to air defense systems, air traffic control and other weapon systems.

Other contract awards include:

Sperry Gyroscope Company, Great Neck, New York, a letter contract of $2,060,665 calling for continued production of MA-2 automatic flight control systems for B-52 Stratofortress bombers; General Electric Co., West Lynn, Mass., a supplemental agreement contract of $1,078,732 for facilities for the production of B-52 Stratofortress components; Hughes Aircraft Co., Culver City, Calif., $1,038,224 for inspection and repair of Falcon Weapon Systems at Tucson, Ariz.; Hayes Aircraft Corp., Birmingham, Ala., $1,500,000 for inspection and repair of C-119 cargo craft; Aerodex, Inc., Miami, Fla., $1,059,070 for overhaul of aircraft engines; Flight Enterprises, Inc., Windsor Locks, Conn., two letter contracts: first, $3,102,137, for the maintenance of C-124 Globemaster cargo craft and second, $1,102,137 for inspection, repair, reconditioning and maintenance of C-121C and C-54 cargo craft; General Motors Corp., Alison Division at Indianapolis, Ind., $7,573,500 for production of J-71-A-2 turbo-prop engines and certain engineering specification changes.

Navy

The U. S. Navy has awarded a contract for the construction of two guided missile frigates (DLG), including preparation of detailed working plans, at a total fixed price of $40,536,800. The DLG's will be equipped with Terrier guided missile batteries aft and five-inch batteries forward, and will be used primarily as antiaircraft defense for high-speed task forces, screening other ships by intercepting enemy aircraft at ranges unsuitable for conventional weapons.

The U. S. Navy's Bureau of Aeronautics has awarded Raytheon Manufacturing Company a contract for more than $60,000,000 to produce air-to-air guided missiles.

Stephen Brothers, Inc., of Stockton, Calif., won a contract to construct five patrol craft at a total fixed price of $1,088,300. The craft will be constructed with wooden hulls and aluminum deck houses, and will be powered by diesel engines furnished by the builder. These "floating classrooms" will be used at the U. S. Naval Academy, Annapolis, Md., to train midshipmen in seamanship and navigation. These five craft, fitted out with electronic and navigational equipment normally found on the Navy's larger combatant ship types, can be quickly converted to patrol duty in the event of national emergency.

The Navy recently announced that two new contracts for the production of guidance and control units for its new air-to-air guided missile Sidewinder have been awarded. The contracts, in the approximate amount of $14,000,000 and $17,000,000 were awarded to the Philco Corporation and the General Electric Company, respectively. The Bureau of Ordnance stated that the contracts include both Navy and Air Force requirements for Sidewinder missiles.

Sidewinder was developed by the Naval Ordnance Test Station, China Lake, Calif., under the direction of Dr. W. B. McLean, Technical Director, who originated the initial concept of the entire weapon system. It is unique in its simplicity and low cost.

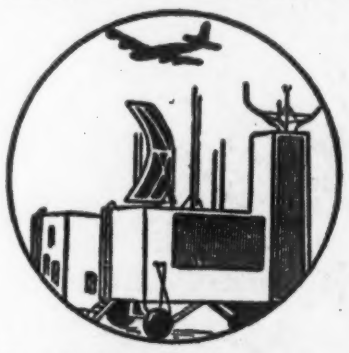
Hoffman Laboratories, Inc., has been awarded a contract for $22 million worth of TACAN air navigation equipment. TACAN is a radio aid which gives an airplane pilot continuous information on his direction and distance from a fixed or moving surface beacon even in the most unfavorable weather.

Westinghouse Electric Corporation, Pittsburgh, Pa., has been commissioned to design and furnish reactor compartment components for a nuclear-powered aircraft carrier. The estimated cost of the contract is $13,157,000.

The aircraft carrier, which will be propelled by eight pressurized water-type nuclear reactors, is being requested by the Navy in the FY 1958 Shipbuilding Program.

INDUSTRY

Airborne Search Radar



General Electric has disclosed that its Light Military Electronic Equipment Department supplied the high-powered AN/APS-20E airborne search radar for the U.S. Navy's New Sikorsky HR2S-1W radar helicopter.

The helicopter is now undergoing initial flight tests. The Navy is evaluating it as a new method of extending a fleet unit's early-warning coverage beyond that of shipboard search radar.

Since radar beams do not bend over the horizon, raising the radar equipment several thousand feet in the air extends its coverage greatly. In most cases, the helicopter radar could detect a low-flying enemy plane more than twice as far away as a shipboard radar.

The helicopter could be carried on an escort carrier or other Navy vessel large enough for a landing platform, with a fleet unit at sea beyond the coverage area of land-based Navy radar picket planes or blimps. It could be sent up as needed, to hover over the ships or fly out beyond them for added radar coverage.

This radar is widely used by the Navy in anti-submarine and airborne early warning airplanes and blimps, and by the U. S. Air Force in its comparable radar picket planes.

Solar Battery Produces Current from Light

Light energy, harnessed through an experimental solar battery developed by scientists of the Radio Corporation of America, was used recently to trigger a charge which severed the tape at the formal opening of a new distribution center of the RCA Victor Distributing Cor-

poration, Los Angeles, California.

To operate the novel device, a light shield was removed from the tiny battery, consisting of a small silicon wafer only 1/10,000-inch thick. The action of light upon the exposed wafer initiated an extremely small electric current. The current flower to a transistor oscillator, which in turn transmitted the impulses to a transistor amplifier and a relay powered by flashlight batteries. The strengthened current then touched off the charge placed at the center of the tape.

New 50-Mile Weather Radar

A new, early warning weather-avoidance radar system, which will enable pilots to "see" and avoid storms up to 50 miles ahead, has been developed by the Radio Corporation of America.

The new radar system is the smallest and lightest of its type ever developed. It weighs only 50 pounds and is specifically designed for the "flyweight" requirements of business and private aircraft. RCA plans to begin commercial production of the 50-mile system (AVQ-50) late this month.

Symposium on Reliability and Quality Control

The Third National Symposium on Reliability and Quality Control in Electronics will be held at the Statler Hotel in Washington, D. C., January 14 through 16, 1957. This symposium is being sponsored by the Institute of Radio Engineers, the American Society for Quality Control, the American Institute of Electrical Engineers, and the Radio-Electronics-Television Manufacturers Association.

It is felt by all those in responsible positions that since the economies of the world are becoming increasingly dependent upon electronic equipment, and as dependence becomes deeper the problems of reliability will become more severe. These problems will be discussed in order to investigate their solutions.

There will be panel meetings and several vital topics such as Commercial Electronic Reliability; Quality Control in Production; Environmental Factors in Reliability of Electronic Equipment, and Trends in Airborne Equipment Reliability.

Radar Echo Simulator

The successful development of a device which will realistically simulate aircraft targets has been developed by Servionics, Inc. The unit, which is known as the "Radar Target Generator, Device 15-J-1-e," realistically simulates the echoes of six aircraft on a variety of radar scopes.

Developed for the United States Naval Training Devices Center at Port Washington, New York, the Radar Simulator is built to rugged specifications, and can be used in either ships or airplanes for initial training and for providing continuing practice to radar operators without tying up aircraft to play the part of the enemy. Although such devices have previously been built, the Servionics unit represents a five-to-one space and weight saving, and uses advanced design techniques usually found only in more demanding fire control equipment.

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W. P. MARSHALL, PRESIDENT

1201

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NL = Night Letter
LT = International Letter Telegram

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AIRWAYS AND AIR COMMUNICATIONS SERVICE
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WASHINGTON, D. C.

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RCA Weather Radar Slated for Australian Planes

The Radio Corporation of America has announced that Qantas Empire Airways, Ltd., of Australia, will equip its fleet of transoceanic passenger planes with RCA weather radar.

Qantas will install 21 units of RCA's weather detection and penetration radar aboard its American-made Super G Constellations.

The radar system, known as AVQ-10, provides pilots with early warning of approaching storm centers as far away as 150 miles, enabling the pilots to follow non-turbulent air paths through and around these storm centers. It is compact and light, weighing only 125 pounds.

Airborne Infrared Lab

Tremendous advances in aircraft and missile development require advanced countermeasures. Today's air weapons attain great speeds, operate day and night at higher altitudes, and are capable of devastating offensive punches. Radar cannot be the sole detector of enemy intruders because of certain limitations.

An airborne infrared radiation laboratory for infrared analysis of airborne targets, designed and manufactured by Servo Corporation of America, New Hyde Park, New York, has been delivered to the French Ministry. The system, called an Infrared Monochromator, will be used by the French Air Ministry for aircraft and missile design, and aircraft defense, as well as for anti-aircraft and missile research.

The gyrostabilized monochromator is suitable for mounting in bomber-type aircraft. It detects intruding planes and missiles and supplies the aircraft designer with a valuable research tool in the development of an airframe system that is least susceptible to detection by an enemy infrared system.

To the eyes of the infrared monochromator, missiles and jet aircraft show as brightly as a lighted candle in a darkened room. The more powerful the engine, the hotter its exhausts; the greater the speed, the higher the skin temperatures. The resulting heat radiations are detected and measured by the monochromator.

Regardless of flying conditions, the infrared monochromator gathers quantitative data on energy radiated from missiles and jet aircraft in flight; analyzes the spectral distribution of energy of airborne targets; and records this information in immediately visible strip chart form.

Do-It-Yourself Automation

Long regarded as an unlikely customer for automation equipment, the small or medium-sized manufacturer can now automate his manufacturing and inspection operations by using "building-block" automation equipment known as MICROtrol, developed by Airborne Instruments Laboratory, Inc., Mineola, New York.

Conventional automation is both expensive and specialized. Consequently, its use is primarily limited to large mass-production firms, whose capital structure permits large expenditures for new equipment, and whose volume of repetitive production is sufficient to amortize the cost of special-purpose equipment on a reasonable basis.

The small manufacturer can frequently assemble mechanical setups for less than he can buy them, and his first-hand knowledge of his own needs often results in a better solution than if outsiders did the job for him. The typical small or medium-sized firm, however, lacks the background necessary to cope with such problems as accurate measurement of dimensions and feedback control of manufacturing processes. It is in these areas that outside help is most in order.

MICROtrol equipment supplies the "eyes, ears, and brains" to control automation's "muscles." In more technical terms, it performs such functions as gaging manufactured products and feedback control of the process machinery. The purely mechanical portions of the set-up are provided by the user himself.

In each instance, the customer selects the combination of MICROtrol units that fits his particular problem, and adds any necessary mechanical appurtenances such as work-feeding devices and locating fixtures.

Each unit is a separate "package," completely self-sufficient, except for the electrical connections (mostly of the plug-in type) that make each unit cooperate with others in the same setup.

Voice-Powered Telephone

Sound-powered telephones are unique in that the voice of the person using them supplies all the power needed to operate the system. Manufactured by the United States Instrument Corporation, Charlottesville, Va., these telephones require no batteries or power connections.

The voice causes fluctuations in the magnetic circuit of the transmitter, which creates an alternating current. This current, too small to be measured by ordinary electric instruments, is transmitted to the receiver where sound waves are created, reproducing the speaker's voice.

Speech is transmitted clearly and distinctly without any distortion, because all static noises usually associated with battery-type telephones are eliminated. Satisfactory transmission of 30 miles or more is assured under normal conditions.

Since the magnetic properties of the Alnico magnets which form the heart of USI Sound-Powered instruments remain virtually constant, these USI instruments have an unlimited useful life.

Constant Ringing Reset Drop

A constant ringing drop, designed particularly for alarm systems where immediate attention is required for protection of personnel and equipment, and where a reset feature is needed for restoration of the alarm system, has been announced by the Edwards Company, Inc.

The constant ringing drop is especially well suited for many types of industrial control alarms, fire alarm systems, and annunciators. It operates in the low-voltage circuit that may be supervised by thermal, liquid level, tachometer switch, voltage or current relay, or other devices sensitive to specific conditions.

(*Continued on page* 16)

AN EXPOSITION OF

Armed Forces Communications and Electronics

EVENT: **AFCEA Annual National Convention**
Armed Forces Communications & Electronics Association

TIME: **May 20, 21, 22, 1957.**
Monday, Tuesday, Wednesday.

PLACE: **Washington, D. C.** Sheraton-Park Hotel—All under one roof.

ATTENDANCE: **Expected 3,500 Military & Business.**
Boston Attendance in 1956 was 1,392.

EXHIBITS: **155 Units. American Manufacturers of Communications and Electronics Equipment for Military Use.**

This Program means business:

Monday, May 20th

8:30 AM—Sheraton Hall
Opening Breakfast
9:30 AM **Official Opening of Exhibits**
10:00 AM—Caribar Room
Chapter Presidents Conference
10:00 AM-12:00—Continental Room
Engineering Papers on Research and Application
12:30 PM—Sheraton Hall
Keynote Luncheon
2:00 PM-5:00 PM—Adams Hamilton Room
Industrial Movies
2:30 PM-4:30 PM—Sheraton Hall
Monitored Panel on Scatter Propagation
7:00 PM—Continental Room
Reception
8:00 PM—Sheraton Hall
Buffet Supper

Exhibits: 9:30 AM—9:00 PM

Tuesday, May 21st

9:00 AM—Caribar Room
Council & Directors Meeting
10:00 AM-12:00—Continental Room
Engineering Papers on Research and Application
11:30 AM—Busses to Naval Research Laboratory
Embark at hotel, clearance at NRL, lunch, tour, return at 3:30 PM
2:00 PM-5:00 PM—Adams Hamilton Room
Industrial Movies
7:00 PM—Continental Room
Reception
8:00 PM—Sheraton Hall
Banquet

Exhibits: 9:00 AM—9:00 PM

Wednesday, May 22nd

8:00 AM—Caribar Room
Officers & Directors Breakfast
10:00 AM-12:00—Continental Room
Engineering Papers on Research and Application
12:30 PM—Sheraton Hall
Industrial Luncheon
2:00 PM-5:00 PM—Adams Hamilton Room
Industrial Movies
2:30 PM-4:30 PM—Sheraton Hall
Procurement Management Forum

Exhibits: 9:00 AM—5:00 PM

For Information write or wire: ***SIGNAL***

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AFCEA at Boston 1956

EDITORIAL

Nine Billion Dollar Baby

For 1956, the scythe of time has completed its rhythmic swing. A new child is about to be born. We stand on the threshold of a new year and a new era and look forward with hope and enthusiasm to greater advancements in industrial progress and technological know-how. In planning for this new era, we must pause long enough to look back, evaluate, and remember the past twelve months as being of great significance in the communications-electronics industry—an industry which really came into its own in a truly American style.

This 1956 nine-billion-dollar baby has put down its grass roots securely in a free enterprise system greater than and as challenging as any in world history. The contributions which it has made to our economic way of life and to national defense have been nothing short of miraculous. But for the industry itself, it is only the beginning. From here on out, the electronics industry is destined to play a greater role in the field of automation, industrial technology, economic mobilization planning, civil defense, and national security.

Considering the first two categories, American ingenuity undoubtedly will provide the necessary essentials for an ever expanding economy, the result being new products and new ideas beyond the scope of imagination. This will require close coordination and a free interchange of ideas to insure economic stability and a maximum degree of flexibility if we are to conserve our natural resources and produce plans for use in case of an emergency.

As for the last three categories, they become increasingly important in the days ahead. They concern each and every one in the electronic field directly and must be included in future planning. In these post-war years the more thoughtful citizens, the more responsible members of the business community, have become increasingly aware of the fact that war is no longer the monopoly of the military. Security is everybody's business. With modern mechanized war, using highly specialized equipment in ships, planes, tanks, and guns in large quantities, the side that wins is not necessarily the one with the biggest formations but the one with the biggest back-up for these formations. Within the circumference of this concept, the electronic industry plays a major role. If the electronic industry is to contribute its share to the production of soft and hard goods, automation and industrial technology most certainly are prerequisites which need no justification. But, most definitely, civil defense, economic mobilization planning and national security stand out as areas which demand prodigious effort and foremost consideration if the Nation as a whole is to enjoy the wonders of the electronic age. Progress, therefore, becomes a relative matter. It must keep pace with out national growth, and it must be accomplished without impairing our economic strength. It is the job of industry and the military to calculate requirements accurately so that the demands for electronic devices remain in balance with material resources availability.

Challenging Question

As representatives of a group of electronic services and agencies, indispensable for the successful functioning of this Nation whether in peacetime or in war, counsel and advice are needed on what is perhaps the most challenging question of our time: How can our Nation most effectively prepare for and deal with the catastrophic

consequences of atomic attack upon our major urban and key industrial centers? It is difficult to grasp fully the realities of atomic warfare. At least we have a starting point—we have but to reread *Hiroshima* by John Hersey to gain an appreciation of a nuclear explosion and its effects on communications operations. The problem before the industry is: What should be done now to improve the state of preparedness, both to minimize the force of such an attack and to accomplish the fastest recovery from the effects of such an attack? What would such an attack mean?

Suggestive Illustration

Let us be content with citing one very minor illustration, not atomic, but which is fresh in the minds of all of us and very suggestive—Hurricane Carol of a few years ago. Here was a storm of major proportions which cost scores of lives and tens of millions of dollars of damage. In the hardest hit communities, tens of thousands of telephones were put out of commission. For the first time microwave was used successfully to re-establish intracommunity communications. To get the telephone back into service quickly, and communications reestablished, the telephone companies assembled repair and maintenance crews from as far south as Washington, D. C. and as far west as Detroit. Now as big as this storm was, as storms go, it was really a minor natural disaster. It was not an atomic bomb—it was a gust of wind. This raises the point: What is the capacity of this Nation to pick itself up and get back on its productive feet in the event of a major atomic attack? It is a problem far greater than civil defense. It calls for industrial recovery and rehabilitation on an incredibly large scale. While Federal agencies are doing a great deal to plan and prepare for such dreaded eventualities, the main job, one might say almost the entire job, will have to be done by private industry. When the chips are down, here is where the burdens and responsibilities of putting this Nation's productive capacity back on its feet will rest. Who, then, should have a better interest in planning and advising our highest governmental agencies for an eventuality which we hope will never happen? What the telephone industry did and what the electronic industry can do—through coordination of its efforts and advance planning—would, as stated earlier, be nothing short of miraculous. We cannot rest in a state of complacency. Neither can the electronic industry allow its progressive thinking to gather barnacles.

Forward Looks

We must look ahead, far ahead, not only to the preservation of our material resources in this new era of automation and industrial technology, but to the preparation of plans for the kind of disaster which this country may be required to face. In this atomic age, national security has become everybody's business—every urban center, every factory, every service installation will be on the front line.

We are all in this business together. The soldier on the battlefront and the workman on the home front are a team; neither can do much without the other. The electronic industry is not purely an industrial enterprise. It is an enterprise dedicated to the defense of our way of life with the defense of civilization at stake. With its progressive work in research and development, its enthusiasm for service, its knowledge of the importance of planning for national security, it will arise to meet the economic challenge of 1957 and continue to make an outstanding contribution to industry and defense. This, then, is the New Year's resolution of a "Nine-Billion-Dollar Baby."

The Editor

Trends of Automation and Electronics in the Army

by Maj. Gen. W. Preston Corderman, USA
Deputy Chief Signal Officer

IN THE PAST FEW YEARS, automation has come into a particular importance of its own in scientific, engineering, business, and Government circles. The word itself is so new that it is not found in many dictionaries. But the concept of automation has deep roots in the industrial tradition of our country.

Age of Automation

Almost 200 years ago there was an automatic flour mill just outside of Philadelphia. No human hands were required from the time the grain was received at the mill until it had been processed into flour. This is only one of many examples of the so-called automatic factory in our early American history. There is, however, one essential difference between these examples of automation and those of today. What was accomplished long ago by mechanical means we now see happening by the use of electrical means. This development stems to a considerable degree from the tremendous increase in electronic controls during World War II. The technical know-how demanded by military problems was quickly seen to have widespread application to industrial production. In short, electronics opened the way to speedier, more accurate, and more flexible controls over a much wider range of operations. As a result, the spread of automation was so accelerated that it is now frequently interpreted as the second Industrial Revolution. Enthusiastic authorities say that we are standing upon the threshold of the Age of Automation.

Increase in Volume

Automation in the factory is just one of its many aspects. The military services have already shown great interest in adapting automation's techniques to the manufacturing process. The Army Signal Corps and the other services have been active and successful in this area. These techniques have tremendous implications with respect to industrial mobilization. Standardization and automatic production of major components and sub-assemblies provide a means for a sudden increase in volume of factory output. Development of a completely automatic assembly of end items will further enhance this capability. An important feature of this means of gaining increased volume is that it will not involve—as it has in past emergencies—tremendous expansion of space and numbers of people. Plants will need only to supplement their capability through the addition of automatic assembly units.

Computers and People

Another aspect of automation is called Electronic Data Processing Systems, more commonly known as EDPS. Involved in these systems are electronic computers, communications, programs and people. I emphasize the word "People." A large segment of the public has been led to believe that these giant computers are self-sufficient and eliminate the worker. The fact is, of course, that these so-called electronic "brains" may be crammed with electronic controls, but certainly not with brains.

This is not meant to detract from the fantastic things of which these machines are capable. Their speed and capacity provide great potential use to the military services. The Army believes that it is merely on the threshold of the payoff which this technique of automation offers. This payoff will include full-scale exploitation of electronic computers in many different kinds of Army activity: logistics, financial and personnel management, record-keeping and research and development. Even more important, we visualize tremendous possibilities for adapting the machines to our requirements for the combat support of the Army in the Field. But, there are a few major problems which the Army faces in adapting EDPS to its operations.

Dynamic State

EDPS in general is in a high dynamic state because of the trend in electronic development and the highly competitive nature of the data

processing industry. Manufacturers and trade publications are constantly announcing improved and less expensive devices, engineering advances and developments. Agencies considering acquisition of computers have a difficult task in determining the most advantageous equipment. If decisions are delayed each time new advances are announced, it is conceivable that years would elapse before an agency would actually procure any equipment. Opinions have been voiced that this dynamic state will continue for at least the next five years. This leaves the Army in the position of having to test new concepts with equipment and systems which may rapidly become obsolescent. The problem is complicated not only by the large cost factor, but it does not permit easy planning for adaption of computers to logistical or combat operations.

Personnel Problem

Another major problem is that of personnel, which is often a critical one in the Army. In working with data-processing systems, we need a large variety of skilled people: analysts, maintenance men, organization and methods examiners, to name but a few. These will have to comprise not only civilians, but men in uniform as well. The current labor market for EDPS personnel can best be described as great demand and little supply. This condition will get worse. Complicating the problem is that no adequate effort has yet been made to formulate standards and criteria for classification and recruitment of the kind of specialist we are going to need in increasing numbers. What we may expect to see happen is that the Army will again serve as a training ground and recruiting source for private industry because of the pay differential.

Uniform Coding System

A third problem is of special interest to the Signal Corps. There is just enough difference in the design of each manufacturer's equipments to make them incompatible. Industry as a whole seems to have little interest in the development of compatible transmission equipment. Of course, this problem of standardization is no new one. At one time, each manufacturer of vacuum tubes made his product just different enough from the others to make interchangeability impossible.

In the case of computers, there is required a conversion of numerical and alphabetical information to coded information for input to the machines. Each manufacturer employs a different code system or a variation of the same code. As a result, tapes from one system cannot be processed by another. A voluntary adoption of a uniform coding system does not appear likely in the immediate future. Certain electronic firms have indicated that conversion devices can be developed, but use of these devices will entail additional cost and processing time.

Transmission

At the present time, data is capable of being electrically transmitted from point to point by teletype, telephone, and radio. However, transmission of intelligence by any of these media is extremely slow, and only a transceiver which processes punch cards provides a self-checking feature to insure the high degree of required accuracy. Unfortunately, methods for the high-speed transmission of data from magnetic tape to magnetic tape have not been developed. Also this type of transmission presents an additional problem because of the incompatibility between the varying machine codes and the communications codes. Communication firms have indicated willingness to develop the necessary equipment, but it appears that specific requirements and sponsorship will have to be furnished by the prospective user.

Cost of Help

Despite these major problems, the Army is moving ahead, adapting what is available to as many different types of operations as possible. We are developing concepts and systems, and training people; and we are looking to a future which holds tremendous promise.

The most obvious and immediate use to which computers can be put is in the area of record-keeping. It is here that EDPS has made its initial impact upon the public and is already being used most successfully.

The rising costs of clerical help and maintenance of records is a growing problem which both business and Government recognize. It is a rare manager who believes that he is overstaffed with clerical help. Yet the cost of this help reached $25,000,000,000 in 1954 and is still rising. In 1940 there were 5 million clerks in industry, or 11 per 100 industrial workers. Today there are 8 million, or 16 per 100 industrial workers. In the Government, it has been estimated that almost half of the total number of Federal employees creates and maintains records at an annual cost of $4,000,000,000. The Federal Government now has enough records on hand to fill 7½ buildings the size of the Pentagon, and before the end of the year it will have created enough new records to fill another one. With the tremendous capacity of electronic computers to process, to store, to memorize and to display information, untold amounts of space, of money, and numbers of people can well be saved.

Another activity in which electronic data-processing machines may prove of significant value is scientific research.

Efficiency of Research

American scientists and technicians are overburdened. Their numbers are critically short. To increase them is a pressing national problem. It has been estimated that up to half the working time of a scientist today is spent merely in learning what is already known. The Government spends more than $1,000,000,000 annually in such research. If, through electronic devices, we can develop means for discovering more quickly what has already been done and avoid duplicating findings already established, we shall greatly increase the efficiency of our research and development efforts.

Other types of Army activity lend themselves equally well to machine application. Almost every technical service of the Army has already installed or is planning to install high-capacity machines capable of providing accurate, timely records for the control of men, money and material. It is in the latter field of logistics that EDPS holds greatest promise. The Army today controls about 1,000,000 items of supply. Its inventory is

valued in excess of $20,000,000,000. It wrestles continually with problems of planned production, lead-times, obsolescence, rapid requisition delivery cycles, personnel and economy.

A substantial part of the answer may be found in mechanization of control point operations by means of data-processing systems. The advantages which are expected are many. The speed and accuracy of data handling will give us more adequate information on which to make our decisions involving procurement and distribution. We will be able to determine more rapidly and accurately the location of stocks and effect trans-shipments in less time. We anticipate large personnel savings. The capability will exist to expand machine volumes in an emergency without corresponding personnel increases. Finally, the Army will have the facility for duplicating records in order to reduce vulnerability. Alternate locations having similar equipment will be able to exchange tapes and instructions and be in a position to continue operations in the event of a disaster.

To accomplish these objectives, of course, will require time and the elimination of some major problems. However, the Army Signal Corps—and the other services as well—have already made successful tests of these applications. Electronic punch-card communication between our supply depot in Tobyhanna, Pennsylvania, and Headquarters COMZ in France, has indicated considerable savings in administrative handling and transmission times of supply requisitions. This is but a modest beginning.

Data-Processing Network

In the Army's management of its supply and finance activities, a situation exists with which industry and commerce are not generally faced. The thousands of daily transactions which comprise the supply, personnel, and fiscal effort of all the Army's services flow between and among major remote installations and commands in the continental U. S. and overseas. The big job in attempting to adapt EDPS to this situation is one almost primarily of engineering a system capable of providing for rapid and reliable flow of data and the communications network to support this flow.

As a result of a recent survey, the Signal Corps is developing plans for a Data Processing Network to anticipate and support the projected requirements revealed by the daily flow of data. There are today approximately 170 posts, camps, and stations in the United States from which business-type data could effectively and economically originate and be transmitted by electrical means. Based upon a study of installation density, a Data Processing Network has been designed. The network will provide point-to-point communications on a switched basis. Primary switching centers, interconnected with each other, are planned for five major American cities, with secondary switching centers at six other cities. This system will be used for logistical operations only and will probably be expanded to include overseas headquarters.

Potential Users

The ability of the machines to provide this type of control makes them of great future interest to many major Army elements. Headquarters, Continental Army Command, may well find that EDPS will assist in weapons systems, development of tables of organization and equipment, military training, and in other aspects of its management responsibilities. Each of the six Army headquarters in the United States is also a potential user of EDPS. Their control of supply in posts, camps, and stations under their command generates a large volume of routine data. They control and allocate ammunition credits, manage repairs and utilities, and station hospitals. All of these functions lend themselves to machine data processing. But, the most important lucrative field for the application of EDPS is its use in the support of combat operations.

To develop these EDPS applications, we have an electronic proving ground at Fort Huachuca, Arizona. Here, daily, we are testing new devices and techniques in furtherance of four major programs which have been undertaken for the communications support of the Army. Considerable and increasing effort is now being applied to determine how we may exploit EDPS as a means for enhancing these four major objectives.

First is our new system of grid communications, the development of which has been spurred by the need for a system which can absorb the impact of atomic attack and react quickly with maximum flexibility and mobility. With this departure from the present echelon-to-echelon concept of communications, the need for rapid and accurate display of information becomes a must. EDPS may be the answer. It may be able to calculate within a matter of seconds current circuit requirements in order to maintain maximum flexibility and capability. Effective programming of information could give us rapid and reliable data on optimum frequency assignments, physical locations and power requirements for interference-free transmissions.

The second of our four major programs is a Battle Area Surveillance System. This involves all-weather surveillance, by technical means, of the battlefield extending 200 miles beyond the main line of resistance. Here, too, EDPS may well play a very significant role in providing the commander with rapid, accurate, and timely information. From every echelon each day, come thousands of bits of information. Their collation, interpretation, and display are normally time-consuming tasks in which reliability suffers in proportion to the time needed for processing them. Taped and fed into proper type of data-processing machine, they could be collated, interpreted, and displayed in a matter of minutes, or stored indefinitely. The combat commander could receive almost immediate information about enemy dispositions, locations of targets, and strengths of opposing forces.

War Gaming

In the relatively peaceful business of war gaming, EDPS could be of immeasurable help. Suppose a small group of planners sat down and programmed on tape every conceivable action which an enemy would take and every conceivable action which the friendly forces could take. Onto these tapes would go planned troop dispositions, strengths, amount of material, weather conditions, nature of the terrain, and the countless other factors which influence the outcome of battle. Fed into a high-capacity machine operating at electronic speeds, information could be rapidly derived on the scheme of maneuver, a "yes" or "no" to a contemplated action, and the results which might

be obtained from each operation.

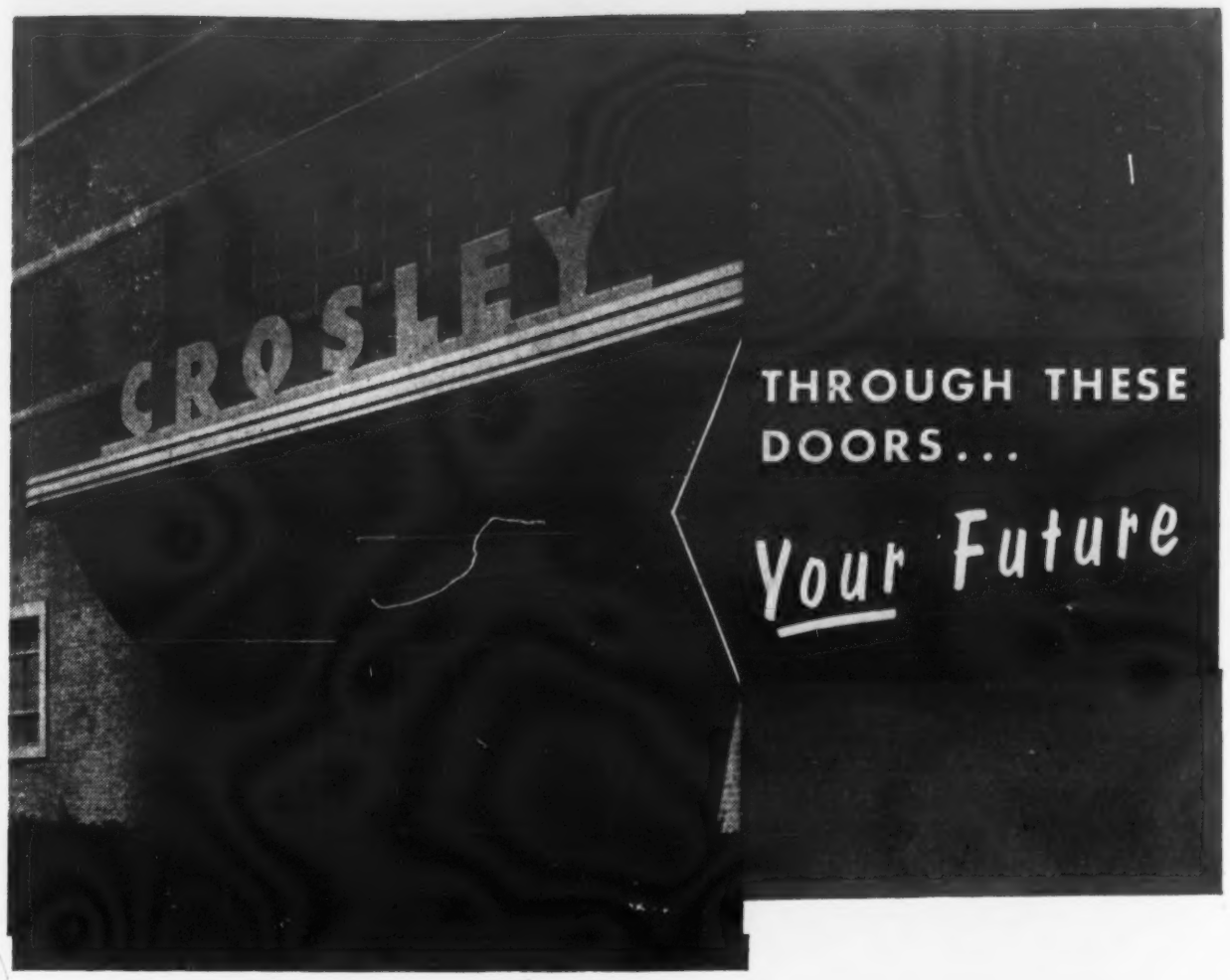
Our third effort is in developing a system for Air Navigation and Traffic Control. The Civil Aeronautics Administration is already employing EDPS to devise new control and navigation techniques. The Army is using modest numbers of light aircraft for logistical support, reconnaissance and surveillance. This equipment poses a need for communication networks, for flight control, and for navigational aids. The electronic computer, already tested and proved by CAA, will have effective application in the Army.

Finally, our fourth program involves Electronic Warfare Systems. EDPS, by rapid collation and display of electronic search activities, will provide means for faster and more effective disruption of enemy communications. On the other hand, it will give us an additional tool to counteract the enemy's activity to destroy or interfere with ours.

In substance, EDPS is another tool for the Army to use. It will be some time before its full potentiality can be realized. While the Army continues to test concepts for its use, it has simultaneously defined certain long-range objectives with respect to computers.

They must be responsive to the varying needs of command. They must have speed and accuracy in the processing and transmission of data. They must be reliable and simple, capable of being installed, operated and maintained by Army personnel. They must be flexible, capable not only of supporting new and improved logistical or administrative systems, but of providing significant support for combat systems. They must be rugged, capable of being employed by the Army in the field, including mobile field units. They must achieve standardization and be engineered for compatibility of input, transmission, processing and output devices.

All of these new techniques which, in sum, comprise what is known as automation, have had a dramatic impact upon the American scene. Responsible people have characterized this as a transitional period in which we stand on the threshold of the Age of Automation. Beyond that, we need to recognize a more basic truth: We are indeed entering upon a new Age —THE AGE OF ELECTRONICS.



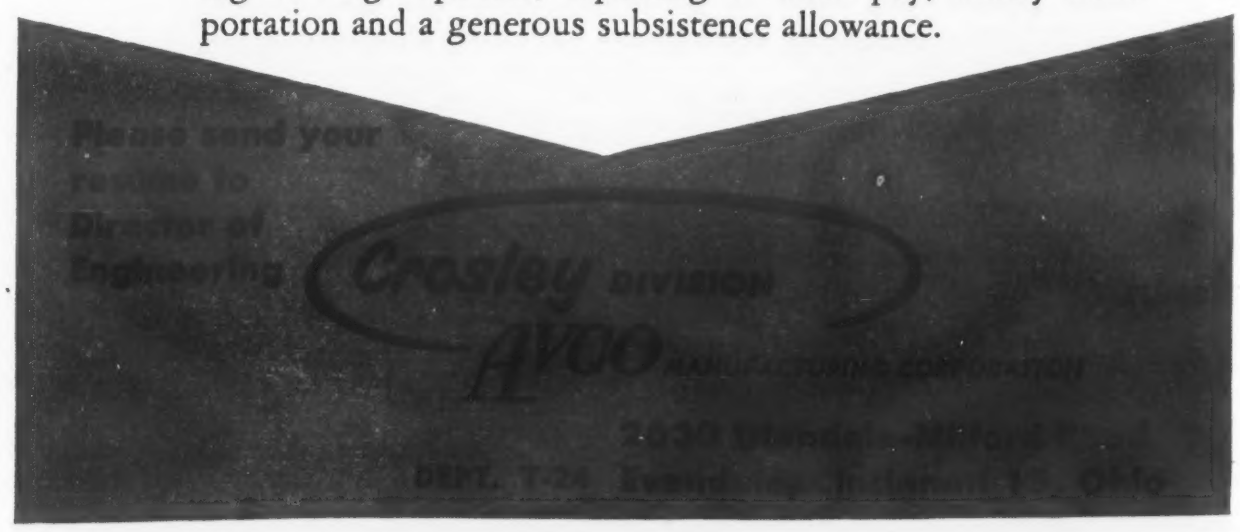
We have present openings for experienced Electronic Engineers in the design and development of ground radar systems, airborne transmitters and receivers and in the electrical systems of guided missile fuzes.

We also have a need for Mechanical, Aeronautical and Structural Engineers of the same experience levels in the design of servomechanisms, the design of large, light-weight structures of the airframe variety and the design and layout of electronic and electromechanical chassis and packages.

In the computer field, we have a need for Physicists and Mathematicians for the programming and solution of engineering problems utilizing analog computers and IBM equipment. Experience in the development of new applications and techniques for digital and analog computers combinations is also desirable. Attractive openings also available for Packaging Engineers, Technical Writers and Illustrators.

CROSLEY'S continued and extraordinary success in the sphere of government electronics, has placed the name of CROSLEY as one of the forerunners in this ever-expanding field. Our present and anticipated demands call for additional engineering personnel at all levels. CROSLEY offers you a partnership in its continued expansion program—"A Partnership in Opportunity."

CROSLEY has numerous company benefits including a group insurance and retirement plan, subsidized educational program, periodic merit reviews and up to three weeks paid vacation after five years. We would also pay relocation expenses including moving expenses, reporting to work pay, family transportation and a generous subsistence allowance.



The Signal Corps Between the World Wars

by Dr. Nathan Reingold

The first volume of the official history of the Army Signal Corps in World War II traces Army communications development during the difficult period ending in 1941, which produced the great technical triumphs of crystal-controlled radio and radar.

The first volume of the official history of the Signal Corps in World War II, *The Emergency*, by Dr. Dulany Terrett, is as thorough in coverage as the other volumes in the multi-volume series, the *United States Army in World War II*, without being written in proper officialese. It has an oddly literary flavor camouflaging the sweat and dust of extensive research while enhancing greatly the readability of the narrative. *The Emergency* is not a magisterial tome answering all questions; Dr. Terrett has tried to present fairly conflicting views on controversies still smoldering and only rarely lapses into the institutional partisanship marring many official histories. The volume contains an appendix listing Signal Corps World War II equipment.

Budgetary Anemia

The Emergency deals with the period between the two World Wars, but has an all too brief introduction in the opening chapter on the origins of the Corps and its World War I experiences. It closes provocatively with an account of the installation of a radar aircraft warning system in Hawaii in 1941 expected to function in "an integrated service by the seventh of December." The bulk of the volume in between concerns the Signal Corps' relations with the three constituencies it impinged upon: science and technology, the combat forces, and industry.

After 1918, Army appropriations dwindled. The Signal Corps had a very small research and development program whose most significant fields were radio and the problem of the detection of objects beyond the range of the human eye. The latter progressed from thermal detection to radar. Signal Corps research and development had few contacts with industrial laboratories or universities, nothing like today's web of contractual relationships. Dr. Terrett calls attention to several instances of superior Navy communications equipment and rightly stresses the advantages accruing to the Navy because its Naval Research Laboratory was empowered to conduct basic research. Budgetary anemia and limited viewpoints of the military restricted Signal Corps research to specific hardware items. Another handicap was a too rigid security system preventing exchange of information, not only with private and foreign individuals, but sometimes with fellow scientists and engineers in the Navy. Under the compulsion of war, both Britain and America profited from the exchange of scientific and technical data starting with the Tizard Mission in 1940, one of the most significant episodes in the Anglo-American collaboration against the foes of Western civilization. Signal Corps research and development between the two wars was important, not so much for its results which were modestly respectable, but because it kept alive a technical tradi-

The Cavalryman demonstrates the radio sending set, SCR-511, used in 1941 at the Cavalry School, Fort Riley, Kansas. The Army post, once the Indian War frontier post of General Custer, was the basic training school for both officers and enlisted of the Cavalry Army.

Dr. Reingold is a staff member of the National Archives. His specialty is the history of science in America.

tion in an often bleak and inhospitable environment.

In World War I, General Pershing authorized Signal Corps installation and control of a uniform communications system from "St. Nazaire to the barbed wire." After 1918, American military doctrine stressed the independent authority of the theatre commander (also a Pershing Dogma), including control over communications. The Signal Corps protested against the resulting diversity of communications systems to no avail. Dr. Terrett has much on training signal units and personnel; perhaps too much. The most interesting and important aspects of the Signal Corp's relations with the combat forces were in research and supply. Here again occurred the classic struggle between the technician, confident in his knowledge of science and technology, and the fighter, impressed by the deadly exigencies of strategy and tactics. Bringing the two into harness is still very much a problem. The Signal Corps was determined to be more than a mere supplier of equipment called for by Air Corps or Armored Force. But in retrospect the former's strictures on radar development and the latter's push for FM were justified in their contexts. By 1940-41, the Air Corps and Armored Force were thinking in terms of armadas of planes and tanks. Between wars penury still dominated the Signal Corps which stressed the need for standardization of equipment after thorough testing and the many problems of procurement. In the long view orderly procedures are preferable to crash programs. Incidentally, *The Emergency* underscores the need for histories of the Air Force not authored by airpower partisans.

Industrial Relations

The problems of procurement were merely one aspect of Signal Corps-industry relations. The Signal Corps relied on commercial communications but established competing services for administrative use and operated a communications system in Alaska. Electrical and electronic fields were dominated by a few large concerns with active research programs. In development and procurement, the Signal Corps had to rely on them. Through the Affiliated Plan the Signal Corps also relied on industry for trained personnel in an emergency. The Signal Corps, like the other technical services, has functions and outlooks identical or analogous to industry's. Certainly the views on labor and profits cited by Dr. Terrett were not New Dealish. But national defense considerations precluded complete reliance on industry. Just as the Signal Corps could not accept Southern California Edison's 1939 offer to operate an aircraft warning system in its area, it could not delegate national defense responsibilities to private hands. As an organ of an Executive Department subject to statutory restrictions, to the vagaries of Congress, and to the scrutiny of the General Accounting Office, the Signal Corps, business-minded though it was, inevitably developed some viewpoints alien to industry. A reading of *The Emergency* raises questions: what did industry think of the Signal Corps as a customer? as a competitor in patent matters? as a competitor for scarce manpower in World War II? as an ally against civilian agencies? as a collaborator and competitor in research? as a source of experienced personnel for its own ranks in peacetime?

This Infantryman, with his "handie-talkie" radio equipment sends a message to his company headquarters during Army field maneuvers in the Carolinas, July, 1942.

Broader Outlooks

Reading this and other histories of the technical services also raises organizational questions. Is the very diversity of functions exercised by the technical services too great and contradictory for efficiency? Or does the existence of diverse functions within one organization help its personnel to acquire broader outlooks? Such questions are unanswerable. This reviewer is inclined to believe that the unique history of the Signal Corps, encompassing torches, flags, telegraphy, heliographs, meteorology, pigeons, balloons, wireless, airplanes, sound detectors, photography, FM, and radar, inclines the balance in favor of the latter view. A contemporary observer of the events in Dr. Terrett's book might have doubted that the Signal Corps could ever leave Limbo. But even at its lowest ebb, between the two wars, the Signal Corps contained men with outlooks greater than their constricted range of operations. *The Emergency* is essentially a story of the preservation and revival of a notable American military tradition.

Copies may be ordered by AFCEA members through the Book Service, AFCEA, at the special price of $3.15. See announcement, page 32 of this issue.

(*Continued from page* 6)

When the controlled condition is returned to normal, warning devices can be silenced or cut out by means of a convenient reset button under the drop. The drop will recycle with the return of alarm conditions.

Pocket-Size Radios

Two pocket transistor radios, weighing less than one pound each, have been introduced by Admiral Corp. The 7M1 series is unique because it is the only one of its size designed to utilize seven transistors on a printed circuit board.

The automatic gain control system in the set is augmented by a special transistor and circuitry which allows the receiver to handle a wider range of signal strength.

Use of transistors in place of vacuum tubes assures greater dependability and service-free operation. They require no warm-up period and consume a minimum of current.

Both sets measure 5¾ inches long, 3½ inches high, and 1½ inch-thick, and contain an outlet for an optional plug-in earphone accessory.

The new receivers will operate for 100 hours on four low-cost penlite batteries, and for 400 hours on four mercury-type flashlight cells.

Tiny Light Cell May Guide Missiles

A tiny light-sensitive electronic device that may be used to guide missiles by sunlight, spot the flashes of distant artillery, or enable blind operators to find plug-in positions in a telephone switchboard, has been described by the Radio Corporation of America.

This is a novel type of photocell, no longer than the eraser on the end of a pencil. The transistor-like cell is capable of sensing with a high degree of accuracy both the direction and intensity of a source of light. The compact device is capable of performing with improved accuracy and efficiency many functions which have been handled previously only with as many as four separate conventional photocells.

The development is based on the recent discovery of a phenomenon that occurs when light is focused by a lens on a semiconductor junction like those used in transistors to generate and control a flow of electrons.

A point of light, focused on the photocell by a lens, will produce a signal between two connections that varies with the angle between the direction to the light and the axis of the cell. These signals can be read with high accuracy to determine the direction and intensity of the light source. At the same time, a third electrical connection produces a normal photocell signal in response to the intensity of the light and independent of its direction.

There are several interesting applications for this device: light communication between moving objects, guided missile navigation, and artillery spotting and range finding.

Another possible use for the cell is to aid blind telephone operators. The extreme compactness makes possible the design of a lens and photocell assembly small enough to mount on a finger in the manner of a ring. The cell would signal the direction to an indicator lamp locating a call on the switchboard. The signal from the photocell would be fed through a special circuit that would translate it into a low audible frequency for transmission into an earphone. This audible signal would fade as the operator's hand neared the right location on the switchboard.

In addition to these applications, the new cell might be used also in a variety of detecting and measuring functions in which signals provided by a light source are translated into various mechanical effects. An example of this is the production of sound from a film sound track.

GENERAL

Armed Forces to Build Minitrack Stations

Ten Minitrack radio tracking stations, to be used in following the movements of and receiving scientific data from the scientific earth satellite, will be built and operated by the Armed Forces.

Seven of the stations will be built and operated by the Army, two by the Navy, and one will be the joint responsibility of the Navy and Air Force.

It is anticipated that within a matter of minutes the satellite can be located in its orbit in any part of the world over which it may be passing, and it will be traceable from one or more of the observation sites as it passes overhead at any time of the day or night, regardless of clouds or fog.

The Army Signal Corps is charged with establishing, maintaining, and operating the far flung Army communications network essential to the satellite program.

Endurance Test in Flight Simulator

It has been revealed that a test will be conducted in February to determine the physical and mental reactions of a flight crew when subjected to prolonged flight.

The five-man crew will be confined in a grounded aircraft cabin for five days and nights to test endurance and efficiency under long-range flight conditions. The test is to be conducted by the Wright Air Development Center of the Air Research and Development Command.

Throughout the "flight" each man will have various duties to perform. From time to time, an "emergency" will arise. A smoke bomb in the air-conditioning system, a change in the instrument readings, and verbal announcements from outside observers are examples of such "emergencies."

All crew members will be "wired" for skin, brain, and heart response readings, and will be photographed by eight motion picture cameras. Two closed-circuit television cameras will keep continuous vigilance over the crew, and all conversations between the subjects and test operators will be tape recorded.

At the conclusion of the 120-hour test, various phases of physical, psychological, bio-electrical, and bio-chemical aspects will be carefully studied and analyzed by specialists in the fields.

Refrigerating Plant is World's Largest

It has been revealed by the Carrier Corporation, Syracuse, New York, that the refrigerating plant for New York International Airport's projected "Terminal City" air conditioning system will break all New York area records for total cooling output. It will also be the world's largest installation of absorption refrigerating units, which use heat to produce cooling.

The new contract, placed by The Port of New York

TI PROGRESS REPORT ON MILITARY TRANSISTORS

FIRST silicon transistors meeting NAVY SPECS

For *reliability* under *extreme* conditions . . . design with TI's military silicon transistors . . . built to give you high gain in small signal applications at temperatures up to 150°C. Made to the stringent requirements of MIL-T-19112A (SHIPS) and MIL-T-19502 (SHIPS), these welded case, grown junction devices furnish the tremendous savings in weight, space and power you expect from transistorization . . . *plus* close parameter control that permits you to design your circuits with confidence.

All 19 Texas Instruments silicon transistor types have proved themselves in military use. First and largest producer of silicon transistors, TI is the country's major supplier of high temperature transistors to industry for use in military and commercial equipment.

degradation rate tests for TI's USN-2N117 and USN-2N118 silicon transistors

test	condition	duration	end point at 25°C
lead fatigue	three 90-degree arcs	—	no broken leads
vibration	100 to 1000 cps at 10 G	3 cycles, each x, y, and z plane	I_{CO} = 2μA maximum at 5V
vibration fatigue	60 cps at 10 G	32 hours, each x, y, and z plane	h_{ob} = 2μmhos maximum
shock	40 G, 11 milliseconds	3 shocks, each x, y, and z plane	h_{fb} = −0.88 minimum for 2N117
temperature cycle	−55°C to +150°C	10 cycles	h_{fb} = −0.94 minimum for 2N118
moisture resistance	MIL-STD-202	240 hours	
life, intermittent operation	P_c = 150 mW, V_c = 30V	1000 hours, accumulated operating time	
life, storage	150° C, ambient	1000 hours	
salt spray	MIL-STD-202	50 hours	no mechanical defects interfering with operation

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Authority, adds four absorption machines of 700 tons capacity each to the five already on order, bringing the total cooling output to 6,300 tons. It would require nearly 200 railway freight-car loads of ice melting daily to produce an equivalent refrigerating effect.

The water chilling machines will use hot water to produce cooling. The machines operate on the principle that evaporation of water produces cooling. Water vapor created in the process is absorbed by a salt solution. As the solution is diluted, it must be continually strengthened. This is done by pumping the weak solution to a generator where steam, hot water, or other hot solutions boil off excess water. The strong solution is returned to the cooling section to repeat the cycle.

Panama Clamors for More TV Commercials

Great concern has been expressed by the television audience in Panama, because there are no TV commercials in the Canal Zone. The Armed Forces Radio and Television Service had carried films and kinescopes of U. S. programs complete with built-in commercials for benefits of Americans in the Canal Zone.

At the request of the Panamanian Government, the commercials were eliminated, resulting in a deluge of demands for the return of the TV commercials.

Recommendations for Educational TV

The executive committee of the National Electronic Distributors Association, under the chairmanship of Richard C. Hall, will make a number of recommendations at the Board of Directors meeting in New York in December.

Among these recommendations was mentioned the need for positive, definite, and immediate action to set up educational programs in color TV and color TV servicing that will enable the distributors' customers, the independent servicemen to compete satisfactorily and successfully with factory service organizations.

Nuclear Bombardment Defense System

Development of a nuclear bombardment defense system to protect underground military and civilian installations in the event of a surprise attack has been announced by the Department of the Army.

The Army Signal Corps Engineering Laboratories at Fort Monmouth, New Jersey, developed the new automatic system which does away with human decision or delay that could spell the difference between survival and disaster. The system detects any atomic or hydrogen bomb explosion endangering an installation, trips relays that instantly sound warning horns, and closes blast doors, turns off gas lines, starts radiologically filtered ventilation systems, and triggers a series of other protective measures.

In order to avoid any chance of failure, the last-ditch protection uses three different detectors, any one of which is tripped by nuclear detonation, but not by any other type of explosion. Warning instruments include a gamma-ray detector, a thermal detector operated by infrared radiation from fission or fusion, and a blast pressure detector. An added feature is a poison gas detector.

Antarctic Construction Postponed

Seven men who were the first Americans to reach the South Pole stepped from a Navy R4D plane into temperatures of 50 degrees below zero on a polar plateau of 10,000 feet. Because of the harsh weather conditions encountered in this late October landing, Admiral George Dufek, Commander Task Force 43, has announced postponement of the Pole construction project until the temperature there rises.

One man had been on snow less than 3 minutes, planting the United States flag, when his face turned white with frostbite. The Navy party left a document with the flag and a radar screen, certifying the date and place of the landing. The snow was so hard that it had to be broken with an alpine ax.

According to the navigator of the plane, the landing was made within four miles of the exact geographical position of the South Pole. The take-off from the Pole was described as most harrowing. Fifteen bottles of Jato (rocket) assist fuel were fired before the plane left the ground. The take-off was made completely by instruments, due to frosting inside and outside the windshield.

Army Engineers Assist in Satellite Program

The task of both developing and applying a coating for the earth satellite has been assigned to the Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Virginia.

Purpose of the coating is three-fold: to give high reflectance to light to minimize heating by absorption of sun radiation; to act as a highly absorbing surface in the infrared to stabilize temperature by high radioactive power in the infrared; and to prevent corrosion of the magnesium surface.

Previous experiments in coating aluminum spheres with silicon monoxide have proved successful, but since the man-made satellite will be of magnesium, it will be necessary to develop a highly oxidized silicon monoxide that will adhere strongly, even during large temperature changes, and protect it from corrosion.

Technician Shortage Tackled

What can America's educators do to prepare more—many more—of today's teenagers for positions as tomorrow's technicians, to equip upcoming eighth-graders for engineering careers?

Against the background of a Russia graduating three engineers to every one in the U. S., solutions to these and other vital questions were explored in a recent meeting between leading New York educators and executives of the Sperry Gyroscope Company.

Purpose of the conference was to determine how high school curriculums in the city and state might be revised to meet expanding technical requirements of American companies. Special emphasis was placed on recent advances in automation, atomics, electronics, nucleonics, and other "new sciences" as they might affect the school courses.

THE RADIO ENGINEERING SHOW

moves to the COLISEUM!

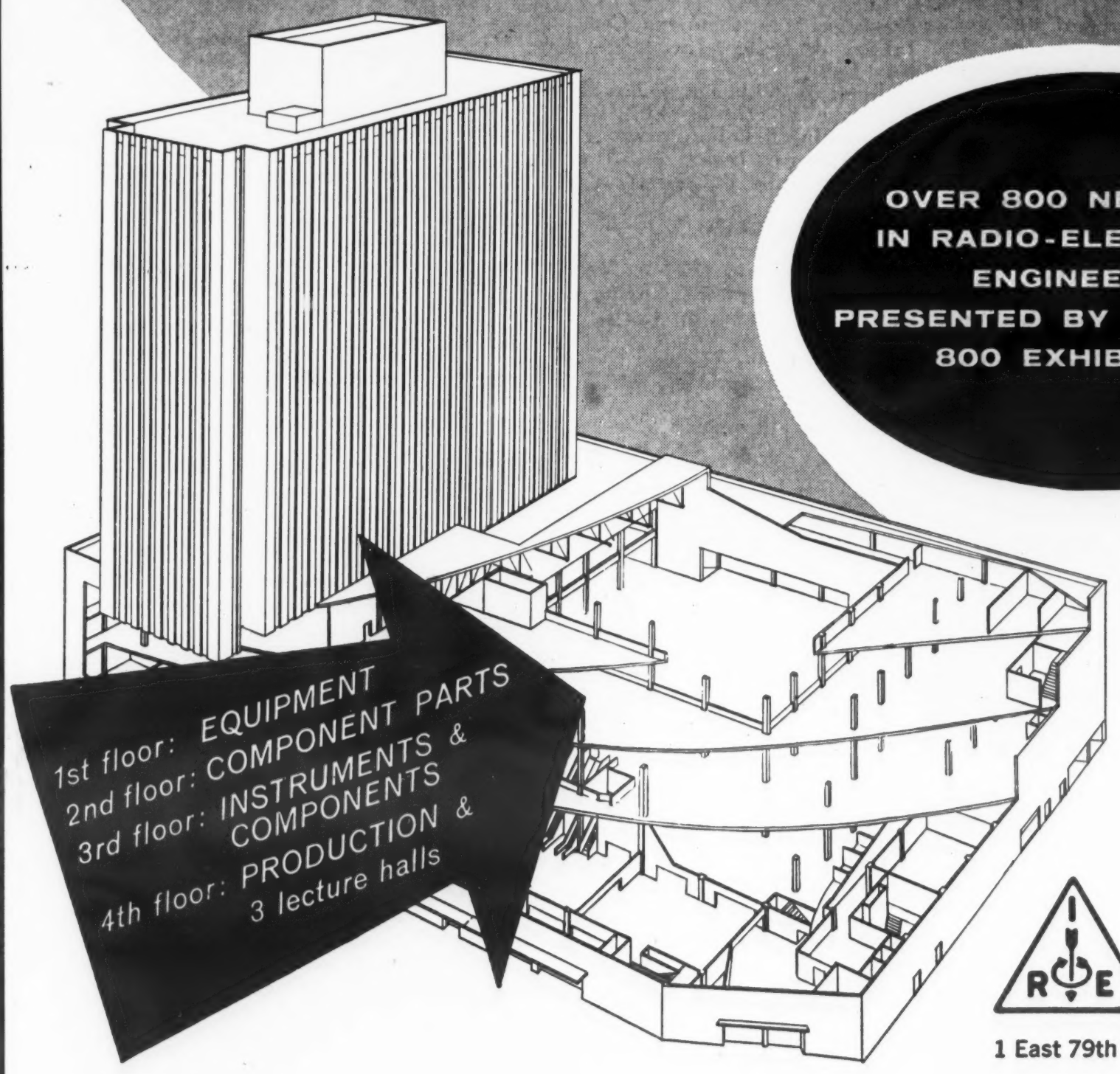
MARCH 18-21 • NEW YORK CITY

SO BIG it takes all 4 floors of New York City's Coliseum to hold this year's great annual IRE Radio Engineering Show. For 4 phenomenal days the largest show ever assembled will open its doors to more than* 41,000* *engineers just 4 minutes from Times Square.

IS IT TOO BIG—not for a 12 billion dollar and still growing industry! More than 200 papers presented by 22 professional groups at the Convention's 55 technical sessions will summarize all that's new in radio-electronics research and development... the 834 exhibitors will also represent over 80% of the productive capacity of the industry. Not by a long shot is this show too big for what will soon be our nation's largest industry. Plan now to be at this vitally important radio-electronics show!

***41,017 engineers and businessmen from coast to coast and in every field of radio-electronics attended the 1956 Radio Show... the forecast for 1957 is even higher!**

OVER 800 NEW IDEAS IN RADIO-ELECTRONICS ENGINEERING PRESENTED BY MORE THAN 800 EXHIBITORS!



The Institute of Radio Engineers

1 East 79th Street, New York 21, N.Y.

AFCEA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Admiral Corp.
Air Associates, Inc.
Aircraft Radio Corp.
Alden Electronic & Impulse Recording Equipment Co.
Allied Control Co., Inc.
Allied Radio Corp.
Almo Radio Co.
American Cable & Radio Corp.
American Electronic Laboratories, Inc.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League
American Telephone & Telegraph Co.
American Telephone & Telegraph Co., Long Lines Dept.
Ampex Corp.
Amphenol Electronics Corp.
Anaconda Wire & Cable Co.
A. R. F. Products, Inc.
Argus Cameras, Inc.
Arnold Engineering Co.
Atlas Precision Products Co.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Barker & Williamson, Inc.
Barry Controls, Inc.
Bell & Gossett Co.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio Division, Bendix Aviation Corp.
Berkshire Transformer Corp.
Blackburn Electronic Corp.
Bliley Electric Co.
Bomac Laboratories, Inc.
British Thomson-Houston Co., Ltd.
Bruno-New York Industries Corp.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
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Collins Radio Co.
Columbia Broadcasting System, Inc.
Contraves Italiana
Compagnie Francaise Thomson-Houston
Convair, Division of General Dynamics Corp.
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Craig Systems, Inc.
Crosley Division-Avco Mfg. Corp.
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Designers for Industry, Inc.
DeVry Technical Institute
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Pacific Mercury Television Mfg. Corp.
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Packard-Bell Co.
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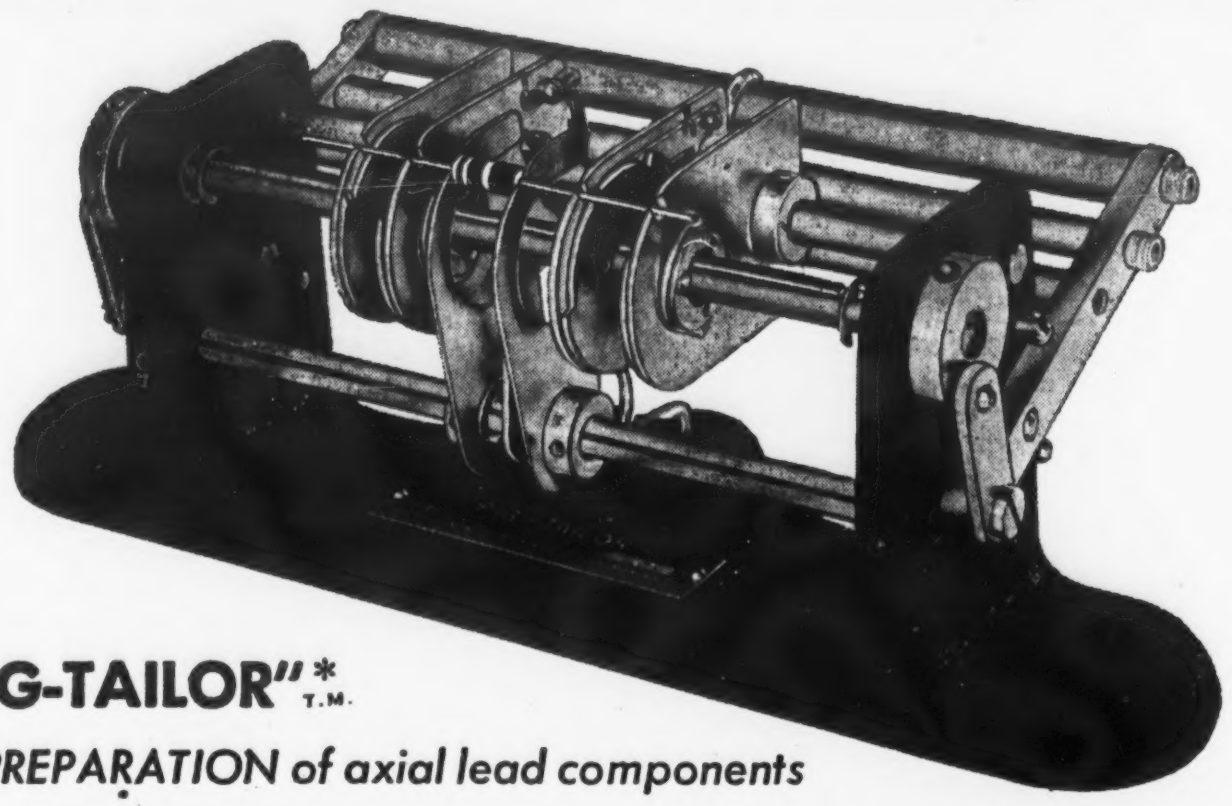
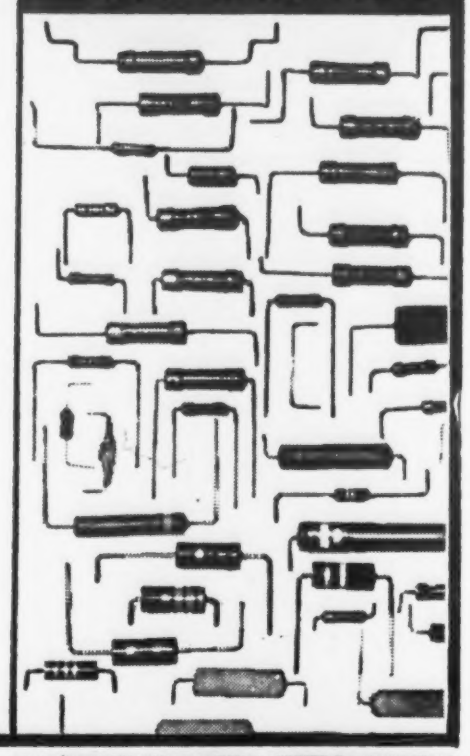
PROVEN-on the assembly line!



"PIG-TAILOR"* T.M.

For PREPARATION of axial lead components

PREPARED COMPONENTS IN SECONDS WITH THE "PIG-TAILOR"



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. . . . a revolutionary new mechanical process for higher production at lower costs. Fastest PREPARATION and ASSEMBLY of Resistors, Capacitors, Diodes and all other axial lead components for TERMINAL BOARDS, PRINTED CIRCUITS and MINIATURIZED ASSEMBLIES.

The "PIG-TAILOR" plus "SPIN-PIN"—accurately MEASURES, CUTS, BENDS, EJECTS & ASSEMBLES both leads simultaneously to individual lengths and shapes—3 minute set-up—No accessories—Foot operated—1 hour training time.

PIG-TAILORING provides:

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2. Uniform marking exposure.
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6. Individual cut and bend lengths.
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8. Closer cost control.
9. Invaluable labor saving.
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PIG-TAILORING eliminates:

1. Diagonal cutters!
2. Long-nose pliers!
3. Operator judgment!
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6. Broken leads!
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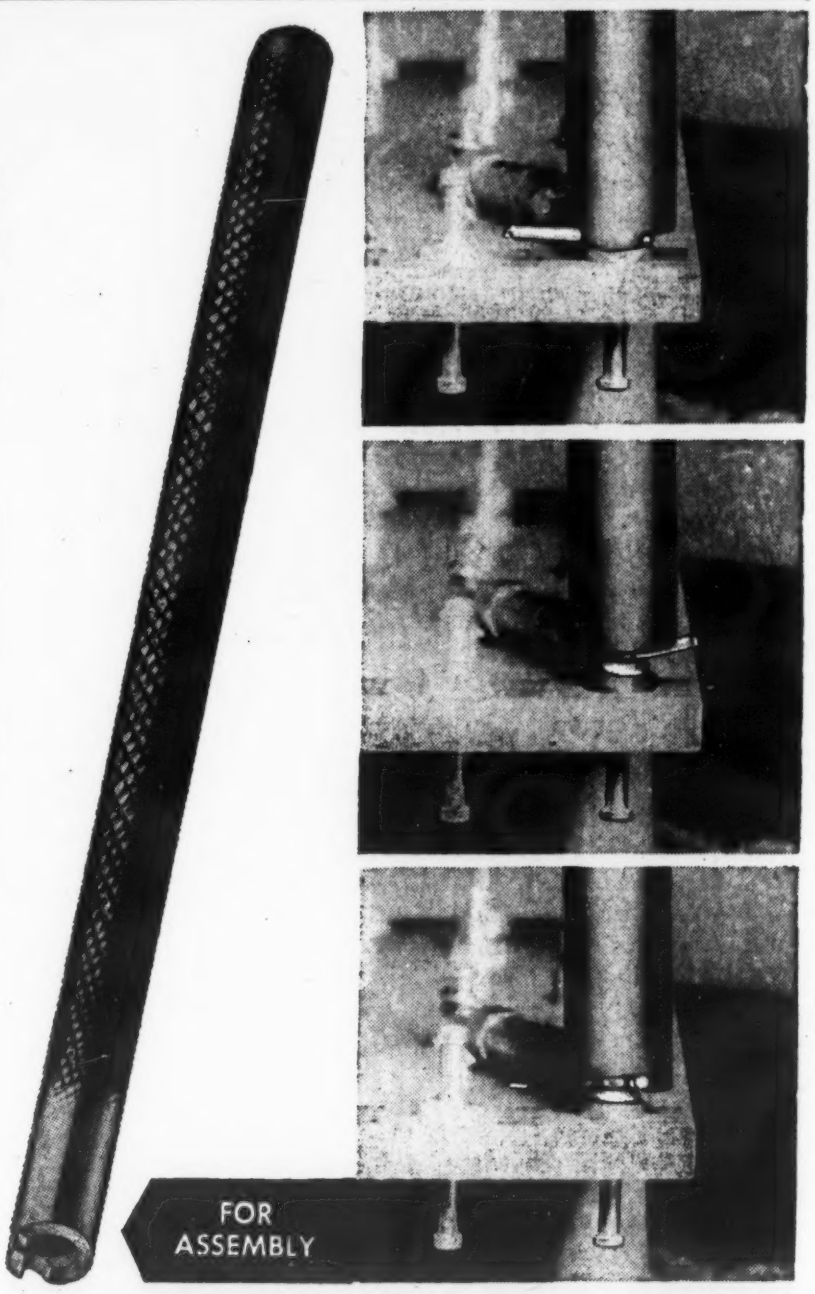
8. 65% chassis handling!
9. Excessive lead tautness!
10. Haphazard assembly methods!



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* PATENT PENDING

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May there be Sunshine in the Windows of Your House

BEST WISHES FOR CHRISTMAS

To our Authors, Advertisers
Printer, Engraver
Members and
Friends.

The
Editorial
Staff

Always
there is
Christmas.

There will always be Christmas as long as there are on earth unselfish men and women who can think of others as well as themselves. Christmas is a package done up in tinsel and wrapped with a pretty ribbon, gay gifts of remembrance. It is a tree with bright lights, smelling freshly of the forest, reflecting the well-being and contentment of the household in which it stands. It is a candle in the window whose cheery light speaks a friendly greeting to the world that passes by. Christmas is the sparkling diamonds of light in the eyes of a little child opening the gifts of the Season; the delighted cries of children playing with their toys and the pleasure in the eyes of parents seeing their children so happy. It is the warm salutation of strangers meeting in the street, wishing each other nothing more than a nod the joys of the Season. It is the warm handclasp of friends expressing in a word or so the joy and the generous spirit of true friendship. Christmas is the time for memories when a furtive tear bespeaks eloquently the sadness of separation and loss; at a time, though, when loved ones far away seem nearer and dearer. It is the beloved carols of Yule sung by your neighbors on your doorstep, and the sermon preached in the little church up the street, and the hymns sung by the choir proclaiming "peace on earth; good will towards men." Christmas is your mother in the savory kitchen, preparing the turkey for dinner, and your dad busily getting in the way. The spirit of Christmas is the light that has dispelled for many centuries past, and will dispel for many centuries to come, the dark clouds of evil that have threatened from time to time past and will threaten from time to time in the future to envelop all mankind. It is the light that has warmed civilization in the darker moments like the sun shining in the windows of your house. The spirit of Christmas proclaims the brotherhood of man. It is more powerful than the mightiest cannon; it has defeated armies; it has broken the strongest chains of servility. The spirit of Christmas has made gentle men into great leaders; it has turned brutal men of evil and avarice into weaklings to be scorned and forgotten. It is the light of goodness and kindness, the light of faith, hope and charity that warms mankind in dark, troublesome moments as the sunshine is warm and comforting coming in the windows of your house...

Chapter News

Dayton-Wright

Maj. L. W. Hieatt of the Air Materiel Command Project Office was the speaker of the evening at the October meeting. The topic of his lecture was "White Alice," the Alaskan Communications System.

Major Hieatt brought out in this speech that this project for the development and installation of an intricate and reliable communication system to augment the continental defense is moving forward despite the almost insurmountable challenges of weather and terrain.

Plans were made at this meeting for the year's program. It is to include a meeting on "TRACAL" at which Col. L. N. O'Connor, Air Materiel Command, will speak; a Christmas party; a meeting at which a member of ARDC will discuss "The Effect of Nuclear Energy Development on the Electronic Industry," and a meeting on Procurement in Air Materiel Command.

Fort Monmouth

"Some of the Unsolved Technical Problems in Atomic Energy" was the subject discussed at the chapter's October dinner-meeting.

Plans were also made for a stag, black-tie banquet in January. Arrangements are being made to procure a well-known speaker from the electronics field for this meeting.

The speaker, an expert on the subject, was Dr. Bernard Kopelman, chief engineer of the Atomic Energy Division of Sylvania Electric Products, Inc.

Gibbs Hall was the scene of the annual meeting of the Fort Monmouth Chapter. After a social hour and dinner held in the Sapphire Room, the meeting was called to order by Mr. Arthur L. Adamson, first vice president acting in the absence of Colonel Fred J. Elser, president. Col. Olin L. Bell, Commanding Officer, Laboratory Procurement Office, Army Signal Supply Agency, was elected chapter president at this meeting. Colonel Elser will become a member of the Board of Directors. A motion was made and seconded that the chapter extend a vote of thanks and appreciation for the fine work done by the outgoing president. The meeting was then turned over to Colonel Bell who first thanked the membership for their vote of confidence. He pledged his continued support and informed the members that he would conscientiously work to promote the best interests of AFCEA during his administration.

Other officers chosen at the meeting were William Christopher, Sylvania Products Co., vice president; J. W. Wopat, second vice president; Mrs. Esther M. Ipri, treasurer; and Lt. Col. M. C. Bowers, secretary.

Beside Col. Elser, the new Board of Directors includes Arthur L. Adamson, vice president, Electronic Associates, Long Branch, Brig. Gen. Earl F. Cook, Norman K. Freeman. Lt. Col. John H. Green, Col. Joseph E. Heinrich, USAR, Col. Stuart S. Hoff, J. Peter Hoffman, Edward F. Kolar, M/Sgt. Joseph J. Pollack and Col. Robert B. Tomlinson.

Maj. Gen. Francis H. Lanahan, USA (Ret.), was the guest speaker at the November dinner-meeting. The former Fort Monmouth Commanding General is now vice president of Federal Electronics Corp., Lodi, N. J.

Gulf Coast

At the chapter's October meeting, Mr. Dabney from the Bell Telephone Exchange in Gulfport introduced Mr. Porter who gave a demonstration of the Bell Solar Battery.

Maj. Don L. Poling, chapter president, reported at this meeting that the guided tour of high-school students through Keesler Air Force Base was very successful. The tour was made on October 10 by 11th and 12th graders from Gulfport High School.

The students were divided into six groups and toured the Basic Electronics Department and the Ground Electronics Department. Chapter members acted as guides for the student tour.

Attending the September 17th meeting of the South Texas Chapter at the Fourth Army Officers Club, Fort Sam Houston, were (left to right): Ben Givens, division manager, Southwestern Bell Telephone Co.; William L. Crow, Civilian Personnel Officer, Fort Sam Houston, who was guest speaker; Stephen H. Simpson, Jr., Southwest Research Institute, chapter president; Col. Robert J. Kuehn, Deputy Chief of Staff, U. S. Air Force Security Service; S. J. Keane, Southwest Research Institute, chapter secretary; and Brig. Gen. Rex E. Chandler, U. S. A. (Ret.), Chairman of the Board, United Services Automobile Association.

The speaker at the Washington Chapter meeting was Hardy Ross, project manager, DEW Line, Western Electric. Seated, from left to right: W. E. Burke, first vice president, Western Electric, Defense Project Div.; Gen. Thomas B. White, Vice Chief of Staff, Air Force; M. C. Richmond, chapter president; Mr. Ross; Monsignor Terrance Finnegan, Deputy Chief of USAF Chaplains; Maj. Gen. Thomas P. Gerrity, Deputy Chief of Staff Materiel, USAF; Vice Adm. R. H. Cruzen, Federal Electric Corp.; Maj. Gen. A. L. Pachynski, Director, Communications-Electronics, USAF.

Hawaii

At a luncheon-meeting on September 7th, newly elected president Meader presented an engraved pen set to out-going president Robello and expressed the appreciation of the membership for the fine work done by Louie Robello and the other officers last year.

The distinguished guest speaker of the afternoon was Mr. P. B. Reed, vice president, RCA Service Co., who spoke on the general problem of maintenance of electronic equipment.

A colored film, showing activities at the Air Force base Missile Test Center at Patrick Air Force Base, Fla., was shown following Mr. Reed's talk.

The chapter's October meeting included a dinner and a tour of the Waipio Transmitting Station and the Helemano Control and Receiver Facilities, all a part of the Hawaiian ACAN station.

Philadelphia

Over 125 members and guests attended the initial meeting of the 1956-57 season of the Philadelphia Chapter held at the Army Signal Supply Agency on Thursday, October 11.

Following cocktails and dinner, newly elected president William F. Powell, Jr., introduced host Brig. Gen. William D. Hamlin who recently assumed command of the Philadelphia Army Signal Supply Agency.

Col. Clifford A. Poutré, Deputy Commanding Officer of the Agency, discussed and demonstrated the Army Computer-Communications System to expedite Signal Supply operations. The installation, recently completed under the supervision of Colonel Poutré, was designed by International Business Machines Corp. The giant electronic computer is the key element of the electronic data processing network that handles requisitions, stock control, and other data pertaining to signal supplies for the entire U. S. Army.

This "brain" can make 30,000 logical logistical decisions per second. It can process 8,000 tabulating machine cards a minute. The tireless worker accounts for and controls the daily changing status of more than 150,000 items of signal communication equipment and supplies. These signal supplies are stored in depots in the United States and overseas according to 40 different categories.

Daily supply information is provided on inventory changes, procurement, substitution of items, repair status, and other types of supply data. The information is memorized in the computer and stored on reels of magnetic tape, 10½ inches in diameter. This stored data is continuously available, and can be reproduced at electronic speeds.

In explaining the electronic computer, Colonel Poutré said, "It is now possible for the Army Signal Corps to do a superior logistical job, because the computer frees us from the operations of a paper mill, gives up-to-date factual information quickly, and gives us the time and means to concentrate on new logistical problems and their solutions. It opens new horizons in Army Supply Management presenting possibilities for advancements as well as creating new types of jobs and training opportunities."

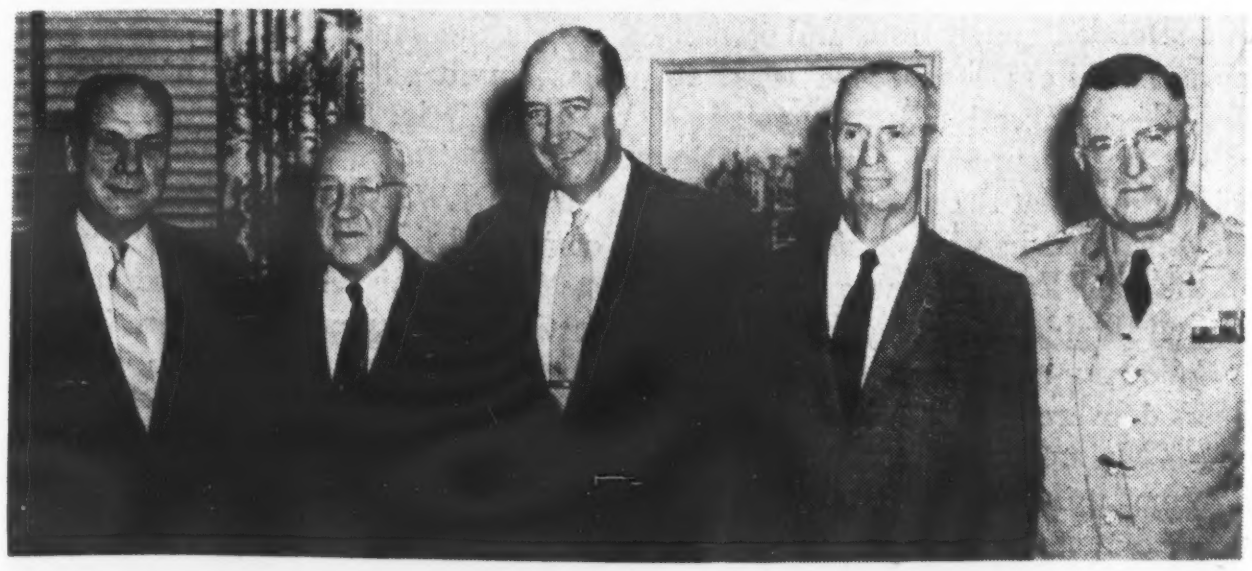
Seattle

On October 10, chapter members met for dinner and to take a tour of the east central office of Pacific Tel. & Tel. Co.

In addition to approximately 40,000 lines of exchange equipment of various types in this office, it is also a terminal office for microwave systems.

Mr. R. D. Camp from the office of the Chief Signal Officer and a member of the Washington Chapter was a guest at the meeting.

Pictured below, at the Washington chapter's September meeting, are, left to right, Maj. Gen. George I. Back, (Ret); Maj. Gen. Harry C. Ingles, (Ret); Honorable Charles C. Finucane, Under Secretary of the Army; Maj. Gen. S. B. Akin, (Ret), and Maj. Gen. J. D. O'Connell, Chief Signal Officer, USA.



CHAPTER NEWS

South Texas

William L. Crow, civilian personnel training officer at Fort Sam Houston was the guest speaker at the chapter's October 17 meeting. The subject of his speech was "The Successful Executive."

Mr. Crow talked on the findings of research in the field of training the successful executive. He also discussed the executive's expected responsibilities, activities, evident characteristics and effective philosophy.

Mr. Crow has had extensive experience in directing executive development programs and conference leadership courses for top-management people. He is a member and past president of the Sam Houston Toastmasters' Club International and an instructor in the Dale Carnegie leadership course.

Tokyo

A record crowd of 210 members and guests greeted two of industry's vice presidents at a luncheon meeting on September 21.

Mr. P. B. Reed, vice president, RCA Service Co., Inc., and Mr. Robert Herr, vice president, Philco Corp., the distinguished guests, are conducting liaison tours in the Far East Theatre in connection with Government contracts with the three Services.

Chapter President James Ramsey paid tribute to chapter members Gen. Donald P. Graul, AACS; Col. Charles J. Harrison, FEAF Hq.; Capt. R. H. Weeks, USN; Lt. Col. Mike Wardell, MAAG "J"; John Wine, AACA, and Robert Fleisher, RCA, for their support of the afternoon's program.

James J. Greene, master of ceremonies for the day, and chapter delegate to the 1956 National Convention, gave his report on the convention. He said, "It was the biggest, best attended convention, and it had more exhibitors than there were at any other convention."

Mr. Herr expressed his delight in being present at the meeting. He also explained that he was on his first tour of the Far East and was having a very profitable and enjoyable visit.

Following Mr. Herr's remarks, Mr. Reed delivered an excellent address on "Maintenance of Electronic Equipment in the Services." Mr. Reed stressed that maintainability and reliability features must be emphasized. He explained that quality, maintainability and reliability must be built into original design. He stressed need for careful systems design, elimination of redundant circuitry, modular construction and ability of equipment to withstand environmental conditions and shock. He said that three important design goals are reliability, reproducibility, and maintainability.

For his concluding statements, Mr. Reed stated that the operating commands must have the capability to maintain equipment. He pointed out further that it is the "Military-Industry team" concept that gives America strength.

Pictured above: Col. Clifford A. Poutré, Deputy Commanding Officer of the Signal Supply Agency in Philadelphia, previews the electronic computer demonstration. Seated at the left is William F. Powell, Jr., chapter president; at the right is Maj. Gen. George I. Back, USA (Ret.), former Chief Signal Officer, USA.

Washington

Mr. Hardy Ross, project manager of Distant Early Warning Line for Western Electric, was the guest speaker at the chapter's November luncheon-meeting. Telling the "DEW Line Story," Mr. Ross supplemented his story with colored sound film and slides which depicted the manner in which the United States Air Force has conquered the wilderness of the Arctic Circle.

"Technically," Mr. Ross explained, "The DEW Line is a radar chain composed first of a number of 'main' stations furnished with aircraft detection equipment and operating as a center of communications, administration, and maintenance. In addition, these main stations will also serve as the northern terminals of a rearward communication route."

Mr. Ross went on to stress the importance of adapting the system to the weather environment. He said, "In the design of the sites, and the electronic equipment in them, every thought has been given to the problems of operating and supporting such equipment under arctic conditions. Parts of the communications systems are being built around the new techniques of tropospheric and ionospheric scatter transmission."

Among the distinguished guests at the head table were: Col. B. M. Wootton, Deputy Director, Communications-Electronics, USAF; Brig. Gen. Stanley. T. Ray, Chief, Electronic Defense Systems, Division of Air Materiel Command; Brig. James C. Jensen, Chief, USAF Central Coordinating Staff, Canada; Air Commodore Robert A. Cameron, Canadian Joint Chiefs of Staff, Washington, D. C.; Maj. Gen. A. L. Pachynski, Director, Communications-Electronics, USAF; Vice Adm. R. H. Cruzen, Federal Electric Corp.; Maj. Gen. Thomas P. Gerrity, Deputy Chief of Staff Materiel, USAF; Monsignor Terrance Finnegan, Deputy Chief of Chaplains USAF; Maj. Gen. Kenneth P. Berquist, Deputy Chief of Staff Operations, USAF; Maj. Gen. Jacob E. Smart, Assistant Vice Chief of Staff, USAF; Lt. Gen. Donald L. Putt, Deputy Chief of Staff Development, USAF, and Richard Horner, Office of the Secretary of Air Force, Research and Development.

Eimac ceramic tubes open up new horizons

The future of many electronic applications depends on the ability of the electron tube to overcome extreme shock and temperature barriers. Anticipating this need, Eitel-McCullough has extended its leadership in transmitting tubes to the development and production of ceramic tubes in the negative grid, klystron, rectifier, and receiving tube field.

Aside from superior immunity to shock damage, ceramic permits new design concepts and optimum production techniques to be employed. The result is smaller, more reliable tubes.

In its new ceramic line, Eimac is enabling the electron tube to overcome old barriers and establish new goals of performance and dependability.

What is your goal beyond present day horizons? With scientific certainty, you may look where you are going. But only dependable tools will enable you to go where you are looking. Make sure you have such tools. Check carefully the incomparable capabilities of performance-proved Eimac ceramic tubes.

For further information on Eimac's full line of electronic tubes, contact our Application Engineering Department and ask for the new Quick Reference Catalog.

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ITEMS OF INTEREST

From Government, Industry and the Services

Wenger Named to Succeed Ankenbrandt as JC-EC Director

Adm. Wenger

Rear Adm. Joseph N. Wenger, formerly on temporary duty in the Bureau of Naval Personnel, has become Director, Communications-Electronics, Joint Chiefs of Staff, succeeding Maj. Gen. Francis L. Ankenbrandt, who retired after 30 years of military service.

Admiral Wenger will also serve as Chairman, Joint Communications-Electronics Committee, Joint Chiefs of Staff, in his new assignment.

He has held key assignments in communications during his military career, and has also gained broad experience in posts at U. S. embassies in several countries. During the years prior to World War II, Admiral Wenger held communications assignments with the Fleet and in the Office of Naval Communications. From 1941 to 1949, he served in the latter office. In 1953, he was transferred to the Joint Staff of the Commander-In-Chief, U. S. European Command, in 1953. He is a graduate of the U. S. Naval Academy.

Gen. Ankenbrandt

General Ankenbrandt, a graduate of West Point, served for 20 years with the Signal Corps, and, for a long period of time, he was assigned to duty with the Army Air Forces. In 1940, he was named Signal Officer at General Headquarters Air Force and AF Combat Command at Langley Field, Virginia.

After top assignments in the Pacific area during World War II, General Ankenbrandt became Air Communications Officer at AF Headquarters, Washington, D. C. When the Air Force was organized in 1947, he became Chief of the Communications Group in the Office of the Deputy Chief of Staff for Operations and was subsequently named Director of AF Communications.

From September, 1951, until September, 1954, he was Chief Signal Officer at Supreme Headquarters Allied Powers of Europe. He was then named Commander of the Airways & Air Communications Service, and in May, 1955, he became Director of Communications-Electronics, Office of the Joint Chiefs of Staff. It is believed that, upon retirement, General Ankenbrandt will assume a role with the Defense-Electronics Division of the Radio Corporation of America.

General Ankenbrandt is a national director of the AFCEA.

"Ham" History

"Ham" history was recently made with a tiny radio transmitter operating on a trickle of current—a fraction of the power used by a flashlight.

Operating their home-made sender, three Raytheon Manufacturing Company hams made history by flashing a message across the Atlantic Ocean to Denmark, 3,800 miles away. According to the American Radio Relay League, official keeper of ham records, the transatlantic hop is the first to be made by a transistorized transmitter.

The transmitter or rig, which uses two Raytheon transistors, was put together in a few hours. Slightly larger than a deck of playing cards, the new rig is a mere dwarf in a field normally reserved for units ranging in size from a television receiver to giants more than six feet high.

By using transistors, size was sharply reduced to a mere 2 x 3 x 5 inches. Since transistors need only a fraction of the power used by tubes, the new transmitter works on less than one tenth of one watt.

The tiny transmitter is also believed to be the first to operate successfully on transistors in the 20-meter band. Transistorized transmitters in the 40-meter range, a lower frequency, have sent messages up to 800 miles away.

In further experiments, the new transmitter was heard by an amateur in Australia. Atmospheric interference, however, prevented confirmation.

Bell System TV Science Series

With the telecast of "Our Mr. Sun" over CBS on November 19, the Bell System inaugurated their new series of entertaining and educational scientific programs. Designed to be of particular interest to the young would-be scientist, the programs are a unique mixture of cartoons and actually filmed scientific demonstrations.

The cast of "Our Mr. Sun," the first program of this series, is headed by Eddie Albert and Dr. Frank Baxter. It also includes Mr. Sun, himself, Father Time, Thermo the Magician, and Chloro Phyll, all of whom are animated cartoon characters. Producer Frank Capra uses the interplay between the human and cartoon characters in a new dramatic technique in the program.

While much of the information of the program was new, emphasis was placed on scientific knowledge rather than on novelty. Subjects on the sun featured in this program were solar astronomy, solar physics and its uses, and biological dependence on the sun. Leading scientists in the solar studies collaborated in preparing "Our Mr. Sun," and actual shots of observatories all over the world, recent experiments, and telescopic photographs of the sun were shown.

Three other programs have been scheduled for 1957. "Hemo, The Magnificent," dealing with the study of blood is scheduled for February. "The Strange Case of Cosmic Rays," the study of Atomic energy, for May, and a study of the weather, yet to be titled, is scheduled for November.

BDSA Plans Industry Advisory Committee Meetings

The Electronics Division, Business and Defense Services Administration, is conducting a series of Industry Advisory Committee meetings during December. Industry Advisory Committee members have been asked to advise the Government whether industrial capacity is adequate to meet mobilization requirements for certain types of electronics components and to recommend solutions in any problem areas that may be located.

The BDSA and the Department of Defense have completed surveys of industrial capacity and mobilization

requirements for selected groups of electronic components. Where productive capacity appears insufficient to meet mobilization requirements, industry members will be asked to determine whether excess capacity for related products could be utilized to correct potential deficiencies and to advise the Government on what other courses of action might be taken to correct deficiencies.

BDSA officials will brief committee members on the current materials situation and the outlook for the future. Members will be given the opportunity to present industry's views.

Mr. Donald S. Parris, Acting Director of the Electronics Division, BDSA, will preside over the meetings.

Powerful Cobalt Source

Admiral Corporation has announced the installation of the Nation's most powerful cobalt radiation source.

The source is an integral part of a specially designed nucleonics laboratory which was opened recently near the company's Chicago headquarters to study radiation damage to electronic components. The three-year project is being conducted for the U. S. Air Force.

This cobalt will be used to subject components such as tubes, resistors, condensers, coils, etc., to gamma radiation in order to study its effect on them.

The new Admiral cobalt source is

(*Continued on page* 30)

DE FOREST RECEIVES FIFTIETH ANNIVERSARY HONOR

The fiftieth anniversary of the invention by Dr. Lee de Forest of the three element vacuum tube, which made modern radio, television, long distance telephony and the electronics industry possible, was formally recognized on November 12 at a brief ceremony which marked the unveiling of a commemorative bronze plaque which has been mounted at the entrance of the building at 229 Fourth Avenue, New York City, by the De Forest Pioneers.

It was in 1906 that Dr. Lee de Forest proved that his dream, the grid vacuum tube, was real; that his audion, as he calls it, could detect, amplify, and control minute radio frequency currents. The inventor's tireless search finally culminated in a patent application in October, 1906.

Initially developed as a dectector, the audion, as an amplifier, made possible long-distance telephoning. The first epochal coast-to-coast telephone conversation in 1915 owed its success to de Forest's invention. Then the audion became the prototype of the billions of radio tubes that have been sold since. Thus all modern radio and television can be said to have been made possible by de Forest's triode tube.

The de Forest vacuum tube is considered by many scientists today to be among the greatest inventions of all time. Its importance is probably only second to that of the wheel in useful and diverse implementation.

Pictured above are Dr. Lee de Forest, Mrs. de Forest, RAdm. Ellery W. Stone, president of the American Cable & Radio Corp., and President, De Forest Pioneers, and Brig. Gen. David Sarnoff, chairman of the Board, RCA; at the unveiling of the De Forest plaque, which honors him on the fiftieth anniversary of his invention of the three element vacuum tube.

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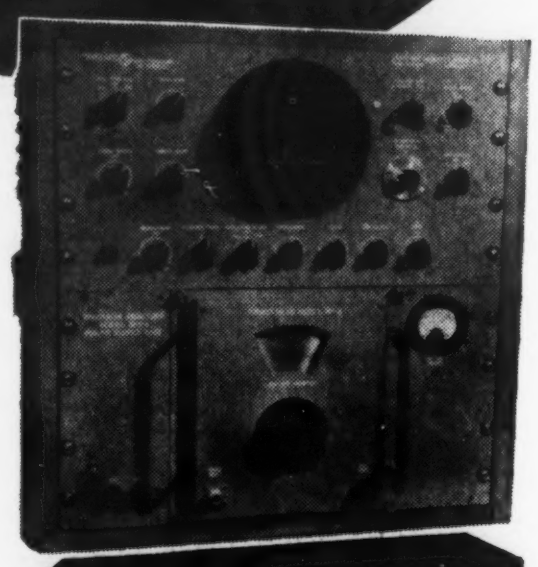

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rated 20,000 curies, which dwarfs the installations in use at medical research centers throughout the country for the treatment of cancer.

The installation contains 3,200 capsule-size slugs of pure cobalt, each measuring ¼-inch thick and one inch long, encased in a 1/16-inch covering of aluminum.

The cobalt is housed in a 12 x 14-foot test chamber with 41-inch thick walls of magnatite iron ore covered with a huge steel "skin." The room has a 26,000-pound laminated steel door and contains a special 36-inch thick glass window through which the technician operating remote control manipulators can view the chamber's interior. Components being exposed to gamma radiation are handled by remote controls.

The radiation chamber contains underground storage holes lined with stainless steel for storing the cobalt when it is not in use. The concrete floor above the storage compartments is covered with a thick layer of concrete mixed with steel punchings to protect laboratory workers from exposure to radiation.

When the components and test apparatus have been arranged in the radiation chamber, the cobalt is raised from its underground storage compartments by externally controlled manipulators.

President Keith S. McHugh (left) of the New York Telephone Co. is shown receiving the Department of Defense Reserve Award pennant from RAdm. M. E. Miles, Commandant of the Third Naval District, in ceremonies at the company's Headquarters Building in New York.

"THE INTERPRETER"

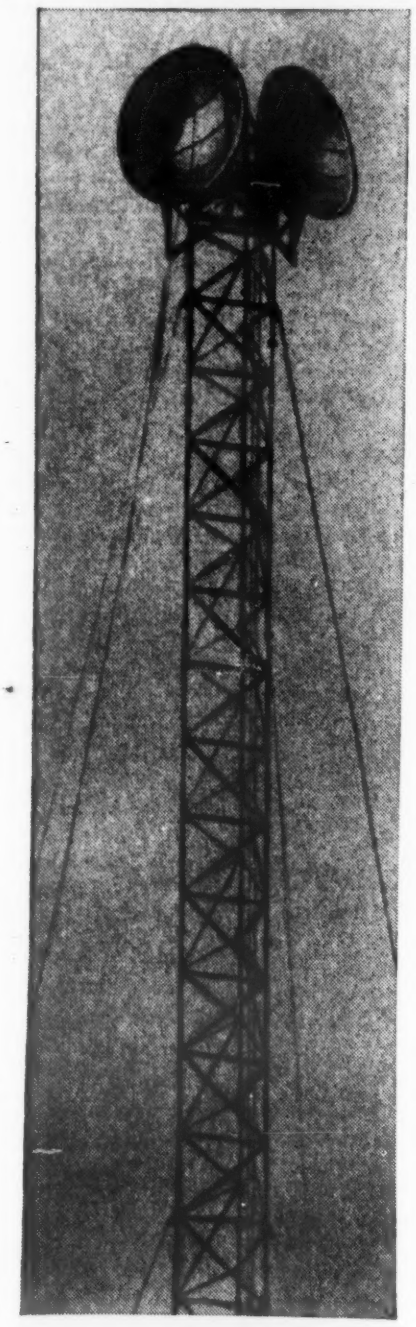
According to the Lewyt Manufacturing Corporation, "The Interpreter," a coordinate data transmitter system engineered to serve as a vital link in SAGE (Semi-Automatic Ground Environment), may one day be used in conjunction with other electronic equipment to control air traffic.

The equipment is now reserved to help identify enemy targets, but it could also help solve the mounting air traffic control problem expected to increase considerably during the next ten years.

SAGE is a complex electronic data processing system being engineered and produced by a number of major companies. It was conceived by the U. S. Air Force and developed with scientists at the Massachusetts Institute of Technology. It is viewed as a semi-automatic means of determining the location of aircraft, of intercepting courses, and of controlling the interceptors or other weapons. Its heart is a giant electronic computer, made by the International Business Machines Corporation.

The principal element in "The Interpreter" is a "memory tube" which stores radar information of enemy target positions. It is capable of accepting 256 different bits of information in 1/698th of a second. The equipment carefully screens and interprets radar pulses at the rate of 161,800 per second.

Automatically separating interference from the target data, it converts this crucial information into signal form for transmission over telephone wires to coordinating control centers. The information, along with other data, is fed into IBM's complex electronic digital computer and translated into a composite picture.



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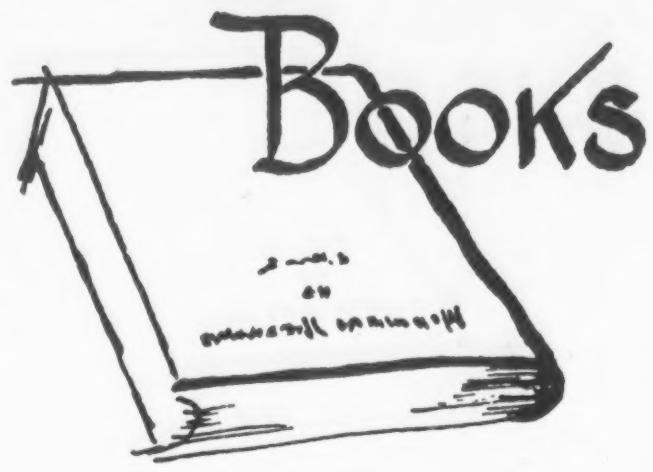

ELECTRONICS, by Merrill Lynch, Pierce, Fenner & Beane, New York 5, N. Y. 40 pages, free.

This is an excellent short survey of the field of electronics. It includes the principal military purchases, both as to scope, items, contract holders and weapons systems concept. New uses in electronic inspection, data processing, instruments and controls, microwave relay and medical electronics are described along with new developments which were shown at the recent annual convention of the Institute of Radio Engineers. Half of the booklet is an individual survey of each of the selected companies in the industry, showing their part of the field, their products, sales and earnings.

Free copies may be obtained from Military Services Dept. MLPF&B, 815 15th St. N.W., Washington, D. C., or any MLPF&B office.

ENGINEERING INSPECTION, MEASUREMENT AND TESTING, by H. C. Town and R. Colebourne. Philosophical Library, New York, N. Y. 192 pages, $8.75.

This latest book on metrology, or the system of weights and measures, will be of value to both engineers engaged in precision measurement and inspection and students preparing for examinations.

Profusely illustrated with photographs and diagrams, this volume first explains the function of the modern factory inspection department, and briefly traces the development of recognized standards and methods of measurement. The principles and practice of precision measurement, and comparators and other inspection and measuring machines, are discussed in later chapters.

Measurement during machining and automatic sizing operations, and screw-thread and surface finish measurement are given good coverage.

FREQUENCY MODULATION ENGINEERING, 2nd Edition, by Christopher E. Tibbs and G. G. Johnstone. John Wiley and Sons, Inc., New York, N. Y. 435 pages, $8.50.

Enlarging and altering the material covered in the first edition, this volume contains a concise and easily absorbed survey of the frequency modulation field. The basic theory is presented in a readily understood form.

Described in the book are properties of waves modulated in frequency, types of interference and noise structures, and propagation of radio signals in the ultra-short wave band. The majority of the book, however, is devoted to the description of techniques and circuits employed for frequency modulation and reception.

Circuits of actual commercial equipments have been used for examples and their component values are indicated.

TRANSISTOR CIRCUIT HANDBOOK, by Louis E. Garner, Jr. Educational Book Publishing Division, Coyne Electrical School, Chicago, Ill. 410 pages, $4.95.

This practical reference book covers over two hundred basic circuits, applications, and data on the uses of transistors. The handbook was written by AFCEA member Louis E. Garner, a noted expert in the field, to fulfill the increasing need for a complete coverage of transistor subjects.

The handbook is divided into four parts covering laboratory practices, basic circuits, circuit applications, and reference material. Only material which is of value to those interested in the field is included in these sections. For instance, Part One on laboratory practices covers a carefully chosen selection of practices which prove helpful when working with transistor circuits.

Part Two covers basic circuits. These are circuits for experimental study or which may be used as "building blocks" in various combinations in the design of equipment.

Part Three covers circuit applications. In some cases, practical construction hints are given. In all cases, values are shown and component types specified. Part Four covers general reference material of value in circuit work.

As a guide to actual applications of transistors, the book contains information for the design engineer as well as for the experimenter. It is also of particular interest to the radio-television technician who needs on-the-job reference data on transistor use.

DICTIONARY OF PHOTOGRAPHY, 18th Edition, edited by A. L. M. Sowerby. Philosophical Library, New York, N. Y. 719 pages, $10.00.

Cross-referenced and containing new texts about up-to-date developments in photographic processes and equipment, this latest edition of a work begun over sixty years ago gives concise yet detailed information on every department of photography.

Although much of the original material is no longer pertinent, those older processes and equipment either available or still in use are included in the volume. Fundamental principles are also covered.

However, this edition, like its predecessors, makes no attempt to report the work of scientists and research workers investigating the photographic process, nor to detail the many specialized techniques now so widely used in industry and research. It is designed as a help primarily to the skilled amateur or the non-specialist professional.

REFERENCE DATA FOR RADIO ENGINEERS, 4th Edition, edited by H. P. Westman. Publication Department, International Telephone & Telegraph Corp., New York, N. Y. 1121 pages, $6.00.

The fourth edition of *Reference Data for Radio Engineers* brings up to date and expands the contents in the previous volume. It also includes new material on such important subjects as modern network design of filters, magnetic amplifiers, feedback control systems, semiconductors, and transistors.

Scattering matrixes, digital computers, nuclear physics, information theory, and probability and statistics are also included in this one-book source of basic material.

The book is primarily a compilation of equations, graphs, tables, and similar data that is frequently needed in general radio engineering and in college instruction. There are approximately 1,000 illustrations and tables in this volume.

Prepared by engineers who are specialists in the numerous subjects covered in the book, it is intensely practical and compact. It brings together data not previously collected in one volume.

HANDBOOK OF BASIC CIRCUITS: TV-FM-AM, by Matthew Mandl. The MacMillan Co., New York, N. Y. 365 pages, $7.50.

Clear and concise, this basic guide covers 136 circuits including virtually every standard form. Each circuit is treated as a complete and separate unit, with a schematic drawing accompanying each one.

Arranged for maximum convenience to the reader, the circuits are listed alphabetically, and a comprehensive index enables the reader to refer very quickly to any point of interest. An extensive appendix in-

cludes the classification and characteristics of amplifiers, standards for monochrome and color television, block diagrams of complete receivers and transmitters, and summaries of the operational theory of complete communications units.

INDUSTRIAL RESEARCH LABORATORIES OF THE UNITED STATES, 10th Edition. National Academy of Sciences—National Research Council, Washington, D. C. 560 pages, $10.00.

This 1956 edition includes information gathered during the first half of 1956 on 4,834 laboratories representing 4,060 companies. The entry for each organization reported shows the names and locations of its laboratories, its principal research executives, the number of professional, technical, and administrative employees in each laboratory, as well as the kinds of research in which they are engaged.

In addition, as an aid in finding individual laboratories or subsidiaries of large companies, an effort has been made to report the entire structure of an organization under its parent company's name. Component units, subsidiaries, and laboratories are cross-referenced.

A simple alphabetical code indicates the type of research only for its parent company or sponsor, or whether it also does fee or contract research for others, whether it offers consultation or advice, and whether it does testing and analysis. The code also indicates whether the laboratory is owned by a commercial organization, by a non-profit research institute, by a trade association, or is an independent commercial laboratory.

SPECTROSCOPY AT RADIO AND MICROWAVE FREQUENCIES, by D. J. E. Ingram. Philosophical Library, New York, N. Y. 332 pages, $15.00.

This volume is suitable for those who wish to apply the techniques of spectroscopy in their own field or to obtain a broad picture of its methods and applications. Although research involves a sound knowledge of physics, this is a general outline for non-specialists. It approaches the subject with an introduction to spectroscopy and develops the study of microwave and radio frequency spectroscopy. Detailed mathematical treatment is avoided.

Considerable space is given to the design of experimental apparatus for those who wish to set up such spectroscopes. A balance is maintained throughout the book between pure and applied research.

PORTRAIT OF A STATESMAN, by Dennis Bardens. Philosophical Library, Inc., New York, N. Y. 326 pages, $6.00.

This personal life story of Sir Anthony Eden is told by a London journalist. In true biographical form, it begins with the impressive Eden family tree. The young Anthony Eden is portrayed here as a thoughtful, sensitive boy for whom there has been too little mischief in life, too much concern with the reaction of his stern, domineering parent.

The volume concentrates on the activities of the mature Eden and therefore becomes an account of Parliamentary affairs and British statesmanship during the past quarter of a century.

THEY MET AT GETTYSBURG, by Edward J. Stackpole. Eagle Books. Harrisburg, Pa. 342 pages, $4.95.

There has been a phenomenal resurgence of interest in recent years in the War between the States, and the Battle of Gettysburg is without exception the bloodiest ever witnessed on this continent. This outstanding book gives us a complete, detailed account of the battle in which more than 50,000, nearly 30%, were either killed, wounded, missing or taken prisoner.

Much has been written regarding Lee's failure to win at Gettysburg and the answers to "what," "where," "how," and "when" can all be found in recorded fact. But, the author has painstakingly sifted the important material from the inconsequential and has furnished us the answer to "why," a combination of factors, no one of which can be considered decisive in itself, but each contributing to the end result.

The book is graphically illustrated with 19 maps and 124 illustrations.

KOREA 1951-1953, by John Miller, Jr., Maj. Owen J. Carroll, and Margaret E. Tackley. Office of The Chief of Military History, Department of Army, Washington 25, D. C. 328 pages, $2.50.

A companion to *Korea 1950* which appeared four years ago, *Korea 1951-1953* takes up where its predecessor leaves off. It spans the period from the dark days of January, 1951, when the Chinese Communist forces were threatening to drive General MacArthur's troops out of Korea, to the signing of the Armistice on July 27, 1953.

The volume is largely comprised of vivid photographs showing fighting scenes from Iron Triangle and Punchbowl to Chip'yong-ni, as well as prisoner uprisings at Kojedo, truce talks and other highlights and shadows. These photographs are backed up by a 71-page text giving a concise history of this period of conflict as based on records and reports of the Far East Command, the United Nations Command, and the Eighth Army.

Like the earlier Korean volume, the new history focuses primarily on the U. S. Army story but it covers also the roles played by the Air Force, the Navy, and the Marine Corps.

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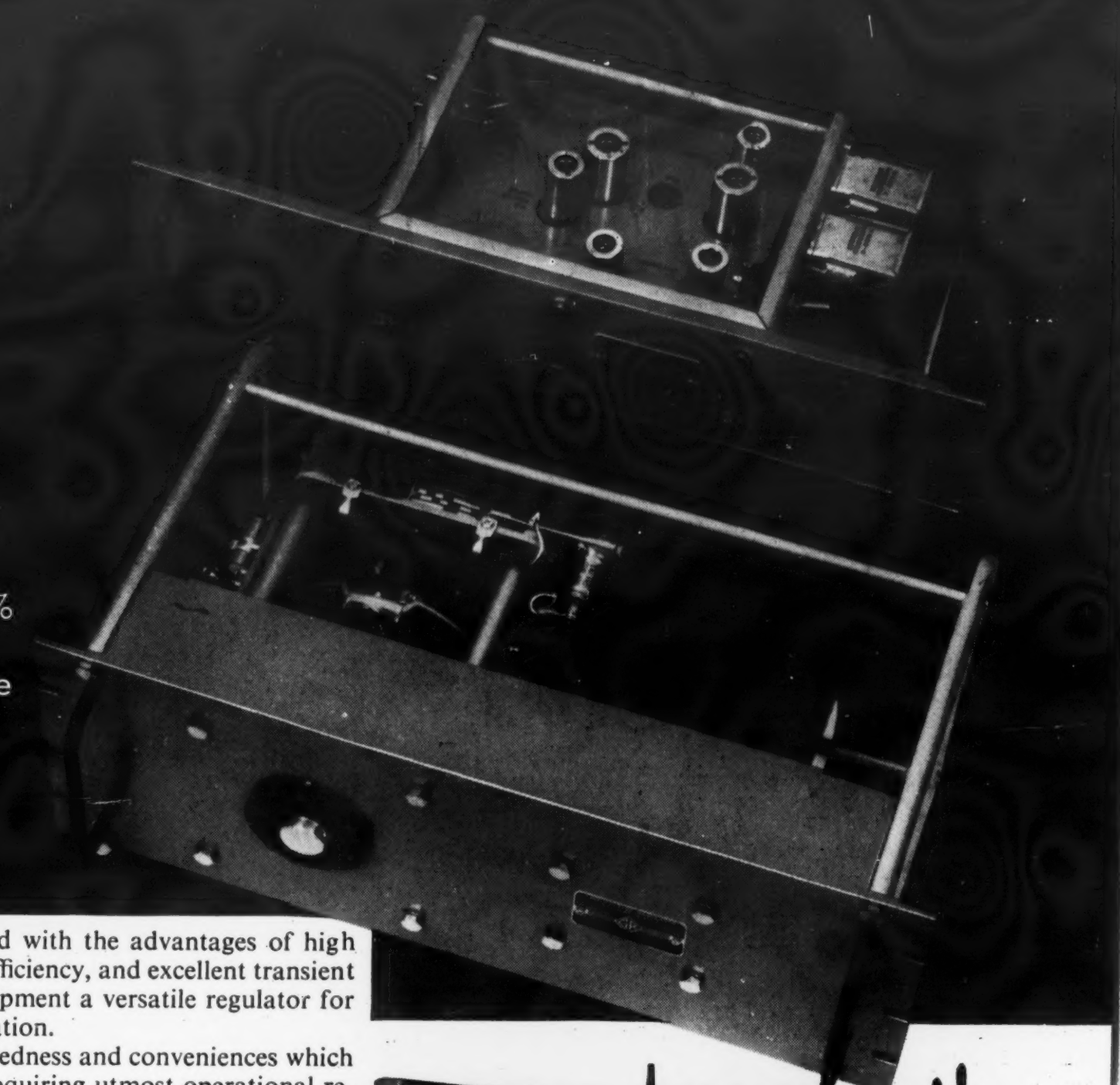

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Fast 10v-per-sec Response

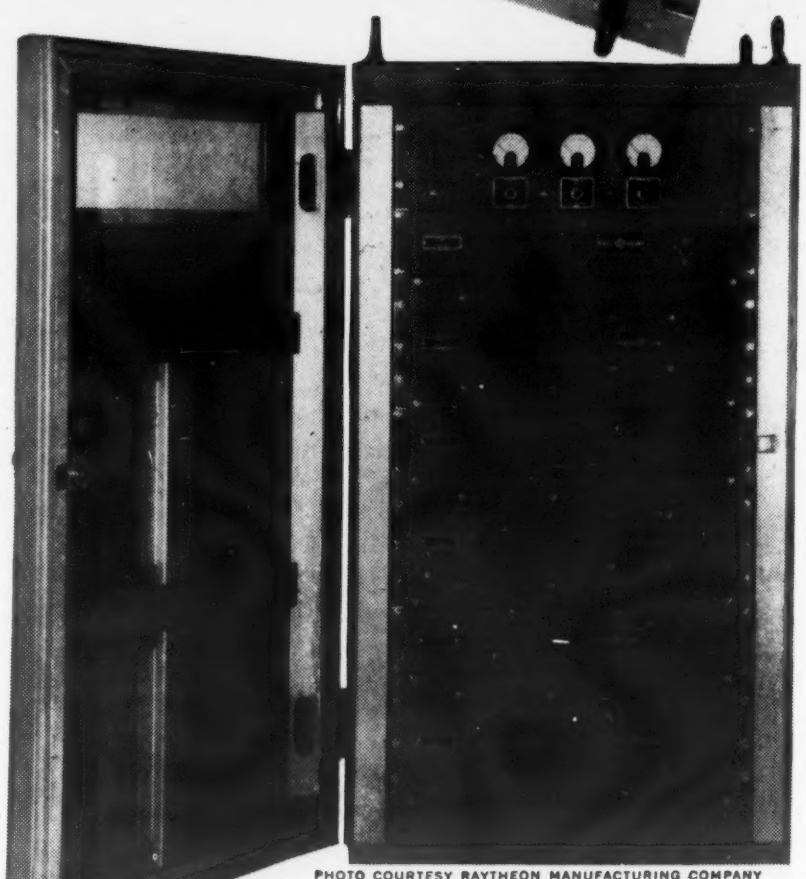
High power handling capacity coupled with the advantages of high accuracy, no waveform distortion, high efficiency, and excellent transient response make this servo-controlled equipment a versatile regulator for laboratory, industrial, or military application.

This new unit features mechanical ruggedness and conveniences which recommend it to many industrial users requiring utmost operational reliability. For example: it can operate at higher ambient temperatures (55°C) without derating; all tubes and components are military types meeting stringent performance standards; the complete hermetic sealing of transformers, capacitors and other components provides maximum protection in corrosive atmospheres.

In addition to meeting military environmental requirements, the unit is designed with particular emphasis on flexibility and accessibility. The electronic circuitry for sampling the output voltage and controlling the servo motor is in a separate package; this "control" section can be used with various combinations of Variacs and "buck-or-boost" transformers in a second package to make possible regulators with various power ratings. This feature also simplifies servicing, since only one type control circuit, interchangeable in all units, is involved. When service of the electronic circuitry is required, only one unit need be removed; the larger unit with all its power wiring can stay in service and will supply uninterrupted power under manual control.

Advanced mechanical design makes this a convenient unit to install and maintain. A complete circuit diagram is silk-screened on the inside of the bottom cover plate; when removed, this plate exposes *all* wiring. Every tube may be replaced directly, and removal of a single dust cover exposes all other components. Component values and circuit designations are etched on the mounting board for rapid, convenient identification. These are but a few of the special features built into this design.

As is often the case, care and consideration given important details make the first-class instrument. Where maximum electrical and mechanical reliability is needed, this Regulator will do the job.



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G-R Automatic Line-Voltage Regulators control 18-kva, 3-phase power for reliable 24-hour a day operation

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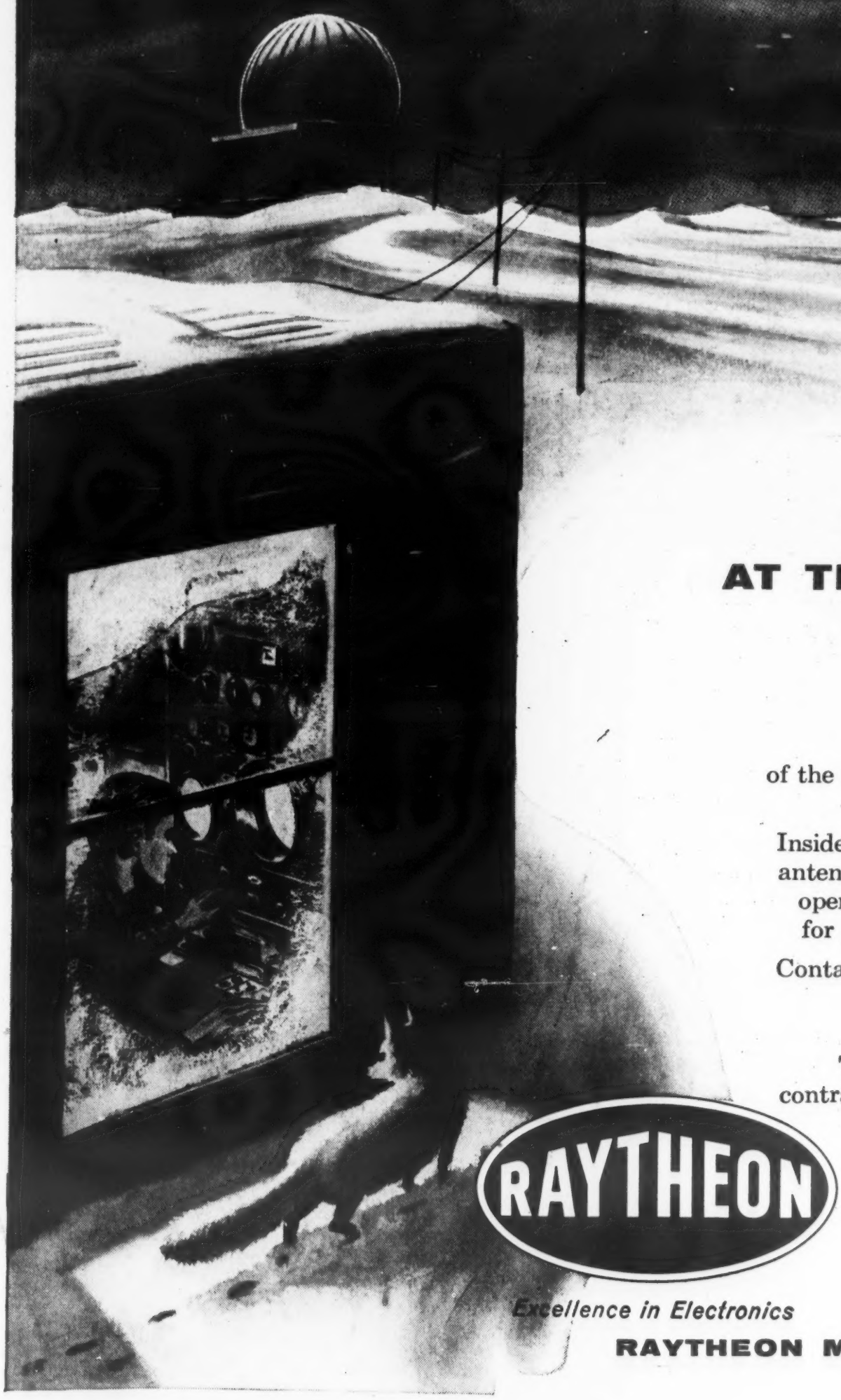

RAYTHEON RADAR AT THE ARCTIC CIRCLE HELPS GUARD US

In the still, snow-shrouded world of the northern lights, strange black domes perch along the barren rim of North America.

Inside these giant inflated "radomes" spin radar antennas probing the skies for intruders. Skilled operators examine glowing radar screens, alert for pips that could mean unidentified aircraft.

Contacts picked up by these DEW line (Distant Early Warning) radars are flashed to Air Defense Command centers.

The U. S. Air Force and Western Electric, contractor for the DEW line, selected Raytheon to develop radar for these critical Arctic stations. We are proud of this choice and of our opportunity, as the world's largest producer of search radar, to contribute to the protection of our hemisphere.

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January 1957

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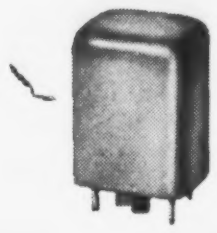
See Page 19

MINIATURIZED TRANSFORMER COMPONENTS FROM STOCK

Items below and 650 others in our catalog A.

HERMETIC SUB-MINIATURE AUDIO UNITS



These are the smallest hermetic audios made.

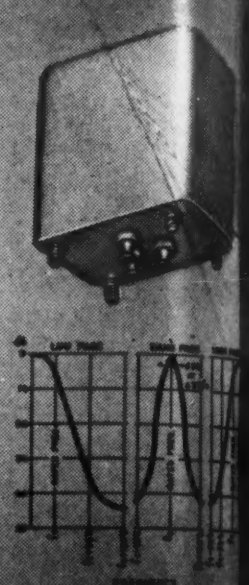
Dimensions . . . 1/2 x 11/16 x 29/32 . . . Weight.8 oz.

TYPICAL ITEMS

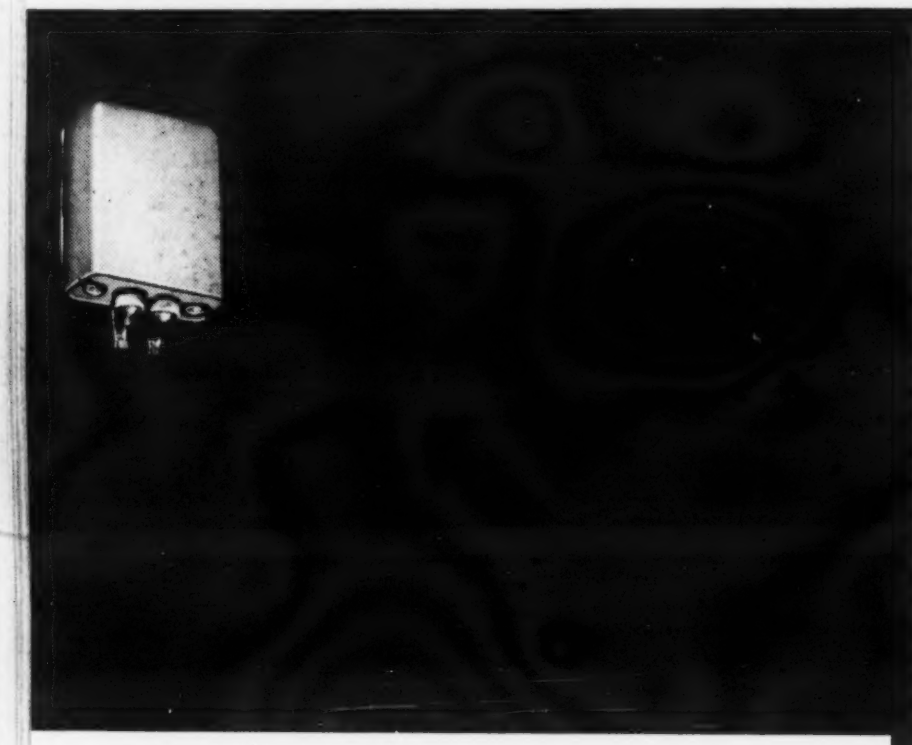
Type No.	Application	MIL Type	Pri. Imp. Ohms	Sec. Imp. Ohms	DC in Pri MA	Response ±2 db (Cyc.)	Max. level dbm
H-30	Input to grid	TF1A10YY	50*	62,500	0	150-10,000	+13
H-31	Single plate to single grid, 3:1	TF1A15YY	10,000	90,000	0	300-10,000	+13
H-32	Single plate to line	TF1A13YY	10,000*	200	3	300-10,000	+13
H-33	Single plate to low impedance	TF1A13YY	30,000	50	1	300-10,000	+15
H-34	Single plate to low impedance	TF1A13YY	100,000	60	.5	300-10,000	+ 6
H-35	Reactor	TF1A20YY	100 Henries-0 DC, 50 Henries-1 Ma. DC, 4,400 ohms.				
H-36	Transistor Interstage	TF1A15YY	25,000	1,000	.5	300-10,000	+10

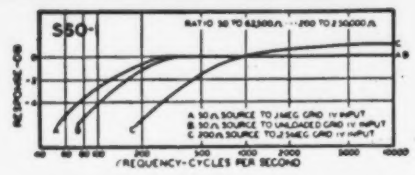
*Can be used with higher source impedances, with corresponding reduction in frequency range and current

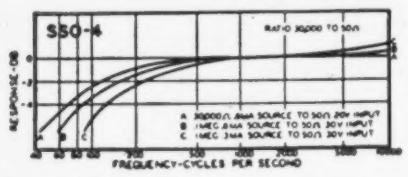
COMPACT HERMETIC AUDIO FILTERS



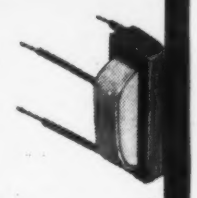
UTC standardized filters are for low pass, high pass, and band pass application in both interstage and line impedance designs. Thirty four stock values, others to order. Case 1-3/16 x 1-11/16 x 1-5/8 – 2-1/2 high . . . Weight 6-9 oz.







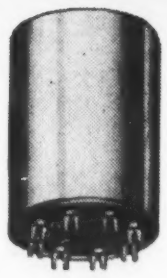
SUB-SUBOUNCER AUDIO UNITS



UTC Subouncer and sub-subouncer units provide exceptional efficiency and frequency range in miniature size. Constructional details assure maximum reliability. SSO units are 7/16 x 3/4 x 43/64 . . . Weight 1/50 lb.

Type	Application	Level	Pri. Imp.	MA D.C. in Pri.	Sec. Imp.	Pri. Res.	Sec. R
*SSO-1	Input	+ 4 V.U.	200 50	0	250,000 62,500	13.5	37
SSO-2	Interstage /3:1	+ 4 V.U.	10,000	0-.25	90,000	750	32
*SSO-3	Plate to Line	+20 V.U.	10,000 25,000	3 1.5	200 •500	2600	
SSO-4	Output	+20 V.U.	30,000	1.0	50	2875	
SSO-5	Reactor 50 HY at 1 mil. D.C. 4400 ohms D.C. Res.						
SSO-6	Output	+20 V.U.	100,000	.5	60	4700	
*SSO-7	Transistor Interstage	+10 V.U.	20,000 30,000	.5 .5	800 1,200	850	

* Impedance ratio is fixed, 1250:1 for SSO-1,1:50 for SSO-3.
Any impedance between the values shown may be employed.



OUNCER (WIDE RANGE) AUDIO UNITS

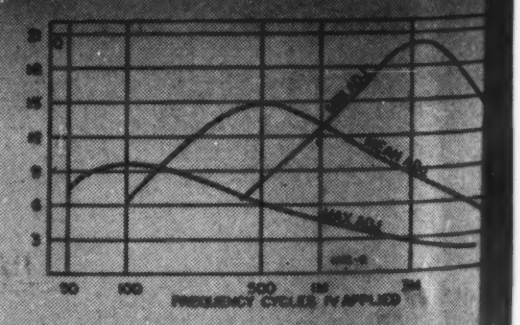
Standard for the industry for 15 yrs., these units provide 30-20,000 cycle response in a case 7/8 dia. x 1-3/16 high. Weight 1 oz.

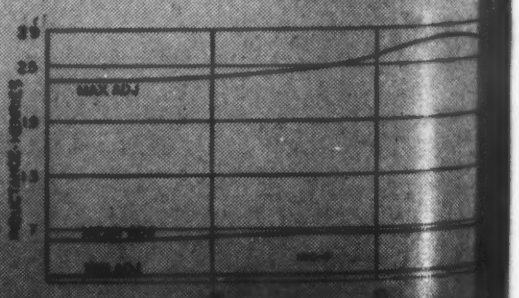
TYPICAL ITEMS

Type No.	Application	Pri. Imp	Sec. Imp
0-1	Mike, pickup or line to 1 grid	50, 200/250, 500/600	50,000
0-4	Single plate to 1 grid	15,000	60,000
0-7	Single plate to 2 grids, D.C. in Pri.	15,000	95,000
0-9	Single plate to line, D.C. in Pri.	15,000	50, 200/250, 500/600
0-10	Push pull plates to line	30,000 ohms plate to plate	50, 200/250, 500/600
0-12	Mixing and matching	50, 200/250	50, 200/250, 500/600
0-13	Reactor, 300 Hys.—no D.C.; 50 Hys.—3 MA. D.C., 6000 ohms		

HERMETIC VARIABLE INDUCTORS

These inductors provide high Q from 50 - 10,000 cycles with exceptional stability. Wide inductance range (10 - 1) in an extremely compact case 25/32 x 1-1/8 x 1-3/16 . . . Weight 2 oz.





TYPICAL ITEMS

TYPE No.	Min. Hys.	Mean Hys.	Max. Hys.	DC Ma
HVC-1	.002	.006	.02	100
HVC-3	.011	.040	.11	40
HVC-5	.07	.25	.7	20
HVC-8	.2	.6	2	15
HVC-10	7.0	25	70	3.5
HVC-12	50	150	500	1.5

LET US MINIATURIZE YOUR GEAR.

SEND DETAILS OF YOUR NEEDS for SIZES and PRICES

Helping to speed your telephone call. Telephone man Byron Jensen tests the intricate equipment that gets your number quickly and accurately.

PHOTOGRAPHS BY ANSEL ADAMS

He keeps an electric brain thinking clearly

You benefit from skills like his whenever you use the telephone

Every time you make a call over a dial telephone, you start an electric brain "thinking" in one of our offices.

First, it tells you when to start dialing by means of a tone. Selects your number automatically from many thousands or millions. Then rings your party or tells you the line is busy.

Such equipment is indeed remarkable. But with all its electronic magic, it still needs the help of people. Day and night, there is continuous checking and maintenance by telephone office craftsmen like Byron Jensen.

"A big part of the job," he says, "is to keep trouble off the lines. For every one of those calls is important to someone. And some can be very important.

"Not only personal calls, but fire alarms, burglar alarms, radio programs and even newspaper pictures go through this same equipment."

Each Sunday Byron teaches a class for boys. Many evenings and week ends are devoted to Boy Scout work.

For a person who enjoys helping others, he finds his telephone work particularly satisfying.

"Whenever I watch those dial switches work," he says, "I get the feeling I'm at the nerve center of the community."

Instructing Boy Scouts. Byron, a troop chairman, shows scouts how to orient themselves with a map and compass in the beautiful Wasatch Range near Provo, Utah.

Working together to bring people together

BELL TELEPHONE SYSTEM